THE LIVING AGE.

No. 903.—21 September, 1861.

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THE OPENING OF THE LEAVES.

The book of nature's glory;
The volume vast and old,
Another true-love story
Beginneth to unfold;
The earth with thousand voices—
The earth no longer grieves;
But blest with hope, rejoices
At the opening of the leaves.

The cottage windows brighten
More early in the morn;
The cherry-branches whiten,
The apple-bloom is born;
Old age to look advances,
And looking, love receives;
The heart of childhood dances
At the opening of the leaves.

Man opens halls of splendor,
And palaces of skill,
And man to man can render
Honor with right good-will;
If songs of praise be given—
If honor man receives,
Oh! lift the heart to Heaven
For the opening of the leaves.

Oh! how the book of glory,
The volume vast and old,
Its ever true love-story
Continues to unfold!
The earth with all its voices—
The earth no longer grieves,
But worshipping rejoices
At the opening of the leaves.

—"*Cottage Carols,*" *by John Swain.*

SUN AND RAIN.

How gloriously the sunshine
Salutes the fields of June!
How dances mid the leafy boughs,
To merry woodland tune!
The shadows shadows chasing,
Of clouds that fleetly pass,
More glorious make the sunshine,
By contrast, on the grass.

But like to little cottagers
Reclining on the earth,
Outwearied with the wild delight
Of their exhausting mirth;
So droops the lovely field flower,
As languid and in pain,—
Bowed to the earth thus wearily,
It breathes a prayer for rain.

The gale with cooler rush comes
Upon the leafy bloom;
All hazy grows the sultry sky—
Clouds in the distance loom:
The lightnings leap out fearfully—
The air the thunder rends;
And all night long upon the earth
The drenching rain descends.

The sunny morn, and cloudless,
Awakes upon a scene
All the more glad and beautiful
Because the storm hath been:
Our hearts have days of sunshine,
But, freshness to retain,
We must have times of cloudiness—
We must have night and rain.

—"*Cottage Carols,*" *by John Swain.*

THE SUNNY SIDE THE WAY

Coldly comes the March wind—
Coldly from the north—
Yet the cottage little ones
Gayly venture forth:
Free from the cloud the firmament
Free from sorrow they,
The playful children choosing
The sunny side the way.

Sadly sighs the North wind
Naked boughs among,
Like a tale of mournfulness
Told in mournful song:
But the merry little ones,
Happy things are they,
Singing like the lark, on
The sunny side the way.

There the silvery snowdrop—
Daffodils like gold—
Primroses and Crocuses
Cheerfully unfold:
Poor? those cottage little ones?
Poor! no—rich are they,—
With their shining treasures on
The sunny side the way.

Coldly oft, the winds blow
On *the way of life,*
Spreading in the wilderness,
Care, and pain, and strife;
Yet the heart may shelter have,
Cold though be the day,
Choosing like the little ones,
The sunny side the way.

—"*Cottage Carols,*" *by John Swain.*

A CALL TO ACTION.

We are living, we are dwelling,
In a grand eventful time;
In an age on ages telling,
To be living is sublime.

Hark! the waking up of nations,
Truth and Error to the fray.
Hark! what soundeth? 'tis creation
Groaning for its latter day?

Will ye play, then, will ye dally,
With your music and your wine?
Up! it is Jehovah's rally!
God's own arm hath need of thine.

Hark! the onset! will ye fold your
Faith-clad arms in lazy lock?
Up, oh, up, thou drowsy soldier;
Worlds are charging to the shock.

Worlds are charging—heaven beholding;
Thou hast but an hour to fight;
Now the blazoned cross unfolding,
On, right onward, for the right.

A. C. Coxe.

From The National Review.

LIGHT AND SUNLIGHT.

Chemical Analysis by Spectrum Observations. By Professors Kirchhoff and Bunsen, of Heidelberg. *Philosophical Magazine for August*, 1860, *4th Ser. vol. xx. p.* 89.

On the Relation between the Radiating and Absorbing Powers of Different Bodies for Light and Heat. By G. Kirchhoff. *Ibid.**

Lecture at the Royal Institution of Great Britain, Friday, March 1st, 1861: On Bunsen and Kirchhoff's Spectrum Observations. By H. E. Roscoe, Esq., Professor of Chemistry in Owens College, Manchester. Report in the Journal of the Institution.

LIGHT is our chief servant in the getting of knowledge, infinitely more swift and subtle than the Magician's servant, Ariel. We think of things almost solely as light informs us about them, and the sound, feeling, and smell of things are but tacked on to our visual notions of them. And through the eye, as through a window, it is said, we look into the souls of others. By light also, nature reveals to us her endless forms of beauty, and the landscape, from some elevated point, fills us with undescribed feelings. And as we use telescopes and microscopes of ever-increasing power, it is still by light we learn the ever-greater and the ever-less.

It is well to remind the reader of the past and present services of light to knowledge, because some exact students of nature, never contented, are about to impose upon their servant new and, if possible, more refined duties than before. Chemists, like others, have long used their eyesight to distinguish one object or substance from another by its color, crystalline shape, or kind of surface. And if, to be more sure, they tried experiments upon a substance, it was but to transmute it into other shapes and colors, of which light again informed them. But we now find that by light we may look at a substance through and through, and see every kind of atom in it. We are, it seems, to keep an instrument by us; and to learn what a thing is made of, we need only drop a particle of it into a flame, and then look through a telescope. Written up in lines of many-colored light, we see the natural sign and name of every element that happens to be present, even though the quantity of matter which thus makes its presence known does not exceed the 1,000,000th or the 100,000,000th of a grain. The public has heard a great deal about *clairvoyance* and *second-sight*, but now we are truly to become clairvoyants, and see into the very composition of matter.

In such terms we may without much inaccuracy introduce this discovery of spectrum-analysis, a method of observing the components of substances which is literally as *plain as daylight*. All who know what the prismatic spectrum is, will understand at the mere suggestion how the process works, but other readers may require some short preliminary explanation. Any ordinary ray of light, especially white light, consists of innumerable simple rays of light, commonly referred to as the colors of the rainbow, and used as the most descriptive expression for numberless variety. As we ordinarily receive light, these innumerable rays are fused together, and their distinctive colors merge by composition into some one tint, or into common white light, such as the sun so bountifully pours down upon us. It is only by this compound ray that in ordinary life we recognize things, and every one knows what a great deal we may do in this way. Optical philosophers, however, from the time of the great Newton, had been aware that we may separate the compound ray of light, and examine each component separately. Passing the ray through a prism, a simple piece of pure glass, with two inclined plane faces, the whole ray indeed is refracted or bent from its course towards that side on which the glass is thicker. But Newton found that every two rays differing in color or kind are bent in a different degree. Thus, however numerous the rays which a compound beam of light contains, we have only to pass it through a prism, and the whole are laid out in the most perfect order in a band of brilliant rainbow hues, known as the *spectrum*. When proper precautions are taken, nothing can express the perfection with which the rays of light are thus sifted out according to their nature. If we conceived dust composed of particles of every size to be let fall into a steady wind, it would all fall to the surface of the earth in time; but the great particles would fall most quickly, and so most straightly, and the

* Translated from Poggendorff's *Annalen*, vol. cix. p. 275.

other particles in proportion, as they were smaller, would fall more slowly, and be carried farther on. Thus the dust would fall, not into a single heap, but into a long band, so graduated that at every point the particles should be perfectly uniform in size. The thickness, then, of the dust at every point will indicate the quantity of dust of a certain definite fineness which existed in the quantity let fall. And if dust of any given fineness were altogether wanting, it would be indicated by a blank space, or bare crossline in the band of dust we have supposed to settle on the ground.

In this experiment we have, then, fully analyzed a mass of dust as regards the magnitude of its particles. It is indeed by a process exactly of this nature that our daily bread is prepared; for every one knows that chaff is separated from corn by a stream of air. In the good old times the thresher used, we believe, to throw the corn and chaff into the air, the wind blowing freely through the two great doors which are seen in every aged barn. Then upon the barn-floor was witnessed the very separation of the light and heavy particles which we had just before taken as an imaginary experiment.

But the illustration represents the phenomena more closely than might be thought. On the wave theory of light, each simple ray of light consists of ethereal waves of some definite length, not less than the 60,000th of an inch, nor greater than the 35,000th of an inch, but of any length within these limits. On the wave length depends the color of the light and other distinctive properties. Now the refracting medium or prism retards the passage of the ethereal waves in a degree depending on the wave length, and it follows from the mechanical nature of the wave, that each ray is caused to bend in a degree proportioned to its retardation. Hence arises the *spectrum*, which we may define as *the series of rays of every kind or color, which a compound ray of light contains, laid out in the successive order of their wave lengths.* Thus far we have used the spectrum as a general term; it is when we come to inquire what are the particular rays which any kind of light exhibits in its own peculiar spectrum, that the subject opens up before us in its infinite diversity. Any perfectly solid substance, indeed, raised to a white heat, gives every kind of ray perceptible to the eyes of men. But there are few or no substances always solid, and any substance becoming luminous in the gaseous state gives a spectrum peculiar to itself, containing a definite combination of rays, recognizable by their color and angular position in the spectrum, such as no other substance could present. When a gaseous substance, then, gives out light of any color, we may consider that all the rays of the continuous or perfect spectrum are omitted, except those which by their combination produce the peculiar colors of that light.

It may seem that the compound ray before prismatic decomposition should be a distinct mark of the gaseous substance from which it proceeds. And so it often is; for half a century back any chemist would have distinguished certain elements, such as sodium and strontium, by the yellow and red color which they give to flame, and it would take a volume to detail all the particular tests for substances depending on their color-properties, long since devised by chemists. But when several substances with their appropriate colors are mixed together, what are we to do? Any two colors, as every one knows, compound into a third distinct color, and any such compound color may be composed, in an infinite number of ways, of other simple colors. The compound color does not spontaneously reveal its composition. Some substances, too, may give out a very powerful light, and others a mere glimmer of color. To strain our eyes in looking at a colored flame in hopes of discerning every trace of color, would be just as profitable as looking for a needle in a bundle of hay. But place the prism before our eyes, —every different color is now referred to a different position in the spectrum, and the weak light is independent of the strong. Every ray may be separately examined, and the needle will not be missed among the hay.

The compound beam of light, then, is like a letter directed to us by an unknown hand, the very receipt of which informs us of the writer's existence, but of little more. Analyzing the light by the prism is like opening the letter; and as in the spectrum we see brilliant lines, the many-colored characters of nature, so in the other have we lines written in pen and ink. Still we are none the wiser unless we know the language of the writing. Until the present time, chem-

ists have scarcely bethought themselves even to open these letters of nature; if they did, the characters within seemed meaningless, or more puzzling than Egyptian hieroglyphics. It is the German Professors Kirchhoff and Bunsen who have studied the language of light, with an acuteness and perseverance worthy of their greatest philological countrymen. They have found the key to the characters, and the first few pages deciphered contain information astonishing by its novelty and correctness.

Among numberless varieties of the spectrum, the solar spectrum is naturally of supreme importance, and we have a rough example of it in the transverse section of the rainbow. Newton first examined the spectrum obtained when the sun's light is passed through a prism, and he stated it to consist of the seven colors, violet, indigo, blue, green, yellow, orange, and red, in unequal quantities, shading into each other. He employed, however, a thick beam of sunlight, so that in reality he had innumerable separate spectra overlapping each other and confusing all the details. Wollaston, in 1802, first used a very narrow band of light, so that each kind of light of definite color would also form a very narrow line or band, like one *weft* or cross thread of a ribbon. The spectrum of compound light then would resemble a broad band or ribbon, continuous or broken, according as all the possible rays of light, or wefts, were present or were wanting. He now observed that the solar spectrum was not continuous, but crossed by narrow dark lines, indicating deficient rays. The excellent German observer Fraunhofer, however, first described the solar spectrum with fidelity, not only *rediscovering* the principal lines, to which he assigned the symbols B, C, D, E, F, G, H, but also actually detecting five hundred and ninety minuter lines with which the spectrum is scored. Brewster carried up the estimate of dark fixed lines to two thousand; and Kirchhoff has lately observed seventy lines between two of the principal lines, D and E, belonging, as we shall see, to one substance only; namely, iron.

The constituent colored bands of the solar spectrum, and the dark lines which separate them, increase in number with the improvement of the apparatus and the care of the observer, almost as the stars increase in number with the power of the telescope. Conceive, then, a piece of ribbon, of which the wefts or cross threads are almost infinitely numerous, no two agreeing in color or coming into contact, and we have an illustration of the solar spectrum. It will then be easily understood how, with these innumerable but invariable details of light and shade, the solar spectrum has become a kind of map, to which all colored rays of light are constantly referred. Knowing that a ray of light corresponds, for instance, to that which forms the edge of Fraunhofer's line D, we know at once all its characteristics of color, refrangibility, length of wave, etc. The mapping of the solar spectrum is, then, an operation almost comparable in importance and accuracy with the determination of the places of the fixed stars, or the trigonometrical survey of a kingdom.

Let us now consider the principal details of the process of spectrum-analysis.

The apparatus employed consists essentially of a prism and two small telescopes, inclined at an angle of about 122°, and so placed on either side of the prism that the first telescope throws the light under examination upon the prism, and the second collects and transmits it to the eye. The ocular lenses of the first telescope are replaced by a plate, in which a slit, made by two knife-edges, is arranged to coincide with the focus of the object-glass. The prism is a hollow vessel, of which two sides are of plate-glass, inclined at an angle of 60°; it is filled with the liquid bisulphide of carbon, which has a high refractive and dispersive power, and can, moreover, always be obtained in a state of uniform purity. When observations are to be made, a gas-lamp of a peculiar construction, in which the gas is mixed with air before combustion, and a colorless but very hot flame thus obtained, is placed just before the slit of the first telescope. The substance to be tested is fixed into a small hook of platinum-wire, or melted on to it, and then placed in the flame somewhat lower than the point at which the axis of the telescope-tube meets the mantle of the flame. According as the substance thus placed in the flame is more volatile, it is more quickly diffused in a gaseous state through the flame, and communicates to it *all the characteristic colors* of the elements it contains. Now, looking through the other telescope, and adjusting the inten-

sity of the light and the magnifying powers at will, we see all these distinctive colors laid out as bright bands in the spectrum. We can see, indeed, only part of the spectrum at once, but then, by turning the prism or the telescope round, every part of the spectrum may be made to move over the field of view.

A very perfect form of the spectrum apparatus has already been made by the celebrated optician Steinheil, of Munich, under the direction of the Heidelberg professors.* The prism is fixed upon the top of a stout iron pillar, two arms from which carry the two telescopes. Of these, the second, or observation telescope, is capable of an angular movement; so that not only may different portions of the colored rays be brought into the centre of the field, which is defined by a thin wire stretched across it, as in theodolites and astronomical instruments, but the angular breadth and interval of separation might easily be measured. A useful addition is a small prism placed over half of the slit at the end of the first telescope. Two kinds of light may now be admitted at once, and yet separately; so that their spectra are seen one above another, and may be easily compared.

To examine or detect the spectrum of any element, its chloride-salt is commonly preferred, as being most volatile, and thus giving the most powerful light. When several salts of different volatility are mixed, some of them are often driven off before the others begin to volatilize, and thus we have corresponding spectra presented separately, like dissolving views. This, however, is an adventitious beauty of the process, and is not usually necessary for the detection of all the elements present, since the several spectra may be distinguished by a practised eye even when all presented at once, the lines seldom falling upon each other, and all being produced in *perfect independence*. This last point is of supreme importance, and therefore, before proceeding, we should notice that Kirchhoff and Bunsen have, by very numerous experiments, confirmed the law before stated by several observers, that the spectrum of each element is produced quite independently of any other substance. Thus it is, theoretically, quite a matter of indifference what compound of a substance, or what sort of colorless flame, we use; the spectrum of the substance will in every case be visible.

Bunsen and Kirchhoff have as yet published their results concerning six of the elements only; viz., the metals of the alkalies and alkaline earths. We will briefly describe them in the following order:—

Calcium. This element, the metallic base of lime, can be examined only in those of its compounds which are volatile; others, like lime, are almost perfectly fixed. The lime spectrum is distinguished by a very characteristic bright green line, referred to as Ca. β in the notation adopted by the professors. A second distinct feature is an intensely bright orange line, Ca. α, lying near the red region of the solar spectrum. There are other yellow, red, or orange rays, of inferior strength and importance. It has been found by certain sure experiments that a quantity of lime no larger than the 100,000,000th part of a grain, when present in the testing-flame, can be detected by that appearance of the two characteristic green and orange rays.

Barium gives a more complicated spectrum than the other alkaline alkaloid metals. But among the many green and orange lines, the green ones Ba. α and Ba. β are far the most distinct, and are a sufficient mark of the presence of this element. From the greater diffusion of the barium spectrum the test is much less delicate; still it was found possible to detect the 60,000th part of a grain of this substance.

Strontium may almost be known without the prism, by the splendid crimson color which it gives to a flame; it is, in fact, the substance used with such effect in making red fire for theatrical and pyrotechnic purposes. Its spectrum, as we should expect, has powerful red bands, six in number, with one orange band, Sr. α, and a very beautiful blue line, Sr. δ, separated, of course, by a considerable interval from the rest. The 1,000,000th part of a grain of strontia can be detected.

Potassium, the element found in *pot-ashes*, gives a widely extended continuous spectrum, which contains only two characteristic lines; namely, one line, K. α, in the outermost red approaching the ultra-red rays, exactly coinciding in position with the dark line A of the solar spectrum; and a second line, K. β, sit-

* We have seen some of these instruments, manufactured by Messrs. Ladd and Oertling of Bishopsgate Street.

uated far in the violet rays towards the other end of the spectrum, and also corresponding with a particular line observed by Fraunhofer. These lines, being situated almost at the extremities of the visible solar spectrum, are not so easy to observe; still the 60,000th part of a grain of potassium cannot escape a careful observer.

Lithium, an element discovered by Arfwedson in 1818, was always thought to be very scarce in nature, and was indeed only known to exist in four varieties of mica, coming from one or two localities on the face of the globe. Bunsen, on examining its spectrum, found it to be most beautiful and characteristic, consisting of a single intensely brilliant crimson line, Li. α, and one less distinct orange line, Li. β. By help of these simple marks, the presence of the 70,000,000th part of a grain of lithium compound may be observed. Now mark the triumphant result of the process: if Bunsen took any substance, and, testing it in the flame, observed a ray of crimson light in the right place, he unhesitatingly declared that lithium was there.

"In this way," say the professors, "we arrive at the unexpected conclusion that lithium is most widely distributed throughout nature, occurring in almost all bodies. Lithium was easily detected in forty cubic centimetres of the water of the Atlantic Ocean, collected in 41° 41′ N. latitude, and 39° 14′ W. longitude. Ashes of marine plants (kelp), driven by the Gulf Stream on the Scotch coasts contain evident traces of this metal. All the orthoclase and quartz from the granite of the Odenwald which we have examined contain lithium. A very pure spring water from the granite in Schlierbach, on the west side of the valley of the Neckar, was found to contain lithium; whereas the water from the red sandstone which supplies the Heidelberg laboratory was shown to contain none of this metal. Mineral waters, in a litre of which lithium could hardly be detected according to the ordinary methods of analysis, gave plainly the line Li. α, even if only a drop of the water on a platinum-wire was brought into the flame. All the ashes of plants growing in the Odenwald on a granite soil, as well as Russian and other pot-ashes, contain lithium. Even in the ashes of tobacco, vine-leaves, of the wood of the vine, and of grapes, as well as in the ashes of the crops grown. . . on a non-granitic soil, was lithium found. The milk of the animals fed upon these crops also contains this widely diffused metal."

We may also mention that its presence in human blood and tissue has been since proved.

A beautiful carmine-colored flame was long since known to be characteristic of lithium; but so long as the prism was not employed, it is obvious that the greater masses of colored light, produced by other more abundant elements usually present, entirely masked and overwhelmed the fainter red due to small traces of lithium. Here the beauty of this method of analysis is surely strongly shown. Let no one think that Bunsen is rash in trusting to the single crimson ray of light as an infallible guide. The process of reasoning can almost always be verified by the ordinary processes of chemical analysis, if it be worth while to take the trouble; but the infallibility of the process was established to the utmost when Bunsen, as will shortly be described, predicted the existence of a minute quantity of a new element, and then procured it!

We may here mention that the process of spectrum-analysis has already been applied by A. and F. Dupré * to the examination of many specimens of water from the Thames, and from the principal London wells. They detected the general presence of strontium and lithium.

Sodium, however, is altogether the *Instantia Ostensiva*, as Bacon would say, or the striking and predominant instance in this subject. It has been long known, indeed, that sodium gives to any flame a strong yellow color, called *homogeneous*, because it is not decomposable into several kinds by the prism. Hence its spectrum consists of a powerful yellow line, capable of resolution, however, by a high magnifying power, into two very close lines. It is also an important fact that this sodium line is exactly coincident with the prominent dark line in the solar spectrum named D by Fraunhofer; that is to say, if both the sodium and solar spectra were allowed to fall over one another, the yellow sodium line would exactly cover the dark solar line D. Now for a long time back, as will appear in our subsequent historical remarks, this yellow line was met by experimenters on colored flames, whatever substances they tried. Bunsen drew the right conclusion, that the test for sodium is

* London and Edinburgh Phil. Mag., 4th Series (1860), vol. xx. p. 373.

inconceivably delicate, and that sodium is present in almost every place and thing. Diffusing a minute quantity of soda in the air at one end of his laboratory, he found a flame at the other end colored yellow in consequence; thus he was enabled to prove that the presence of less than the 180,000,000th part of a grain of soda in the testing flame may be surely detected! The professors truly remark, "that the chemist possesses no reaction which in the slightest degree will bear comparison, as regards delicacy, with this spectrum-analytical determination of sodium."

It is easy also to understand, that as two-thirds of the earth's surface is covered with the saline solution, sea-water, the atmosphere must be impregnated with minute particles of salt; and it is a fact, that every thing exposed to the air for a few hours will become slightly saline.

"That sodium is always contained in the air can be easily shown, by allowing a fine platinum-wire, which has been cleaned by ignition in the flame, to remain exposed to the air for a few hours, when, on placing it again in the colorless flame, a bright flash of the soda line is seen. In the same way, the dust which settles from the air in a room shows the soda reaction; we only need to knock a dusty book near the flame, in order to obtain the wonderfully brilliant yellow soda line."

The yellow color in the last experiment will be quite apparent without prismatic analysis. The wide diffusion of common salt in the air was, however, a fact long known, and proved by the saltness of rain-water. Thus the writer of the present article has, by the common chemical tests, found appreciable and sometimes large quantities of salt present in almost every sample of rain which fell throughout a year. The yellow homogeneous light of sodium is that produced in the familiar Christmas amusement called *Snap-dragon*, when, in the midst of the game, salt is thrown into the dish of burning brandy, and gives to every friendly face, and every object around, such a ghastly yellow hue as few are likely to see and afterwards forget.

As an example of the application of these tests in actual qualitative analysis, we quote the following from Kirchhoff and Bunsen's paper:—

"A mixture of the chlorides of potassium, sodium, lithium, calcium, strontium, and barium, containing at the most one-tenth of a milligramme * of each of these salts, was brought into the flame, and the spectra produced were observed. At first, the bright yellow sodium line Na. α appeared, with a background formed by a nearly continuous pale spectrum. As soon as this line began to fade, the exactly defined bright red line of lithium, Li. α, was seen, and still further removed from the sodium line the faint red potassium line, Ka. α, was noticed, whilst the two barium lines, Ba. α, Ba. β, with their peculiar form, became visible in the proper position. As the potassium, sodium, lithium, and barium salts volatilized, their spectra became fainter and fainter, and their peculiar bands one after the other vanished, until, after the lapse of a few minutes, the lines Ca. α, Ca. β, Sr. α, Sr. β, Sr. λ, and Sr. δ, became gradually visible, and, like a dissolving view, at last attained their characteristic distinctions, coloring, and position, and then, after some time, became pale, and disappeared entirely.

"The absence of any one or of several of these bodies is at once indicated by the nonappearance of the corresponding bright lines."

The facility and certainty of the process are strikingly manifest in the following statement:—

"Those who become acquainted with the various spectra by repeated observation, do not need to have before them an exact measurement of the single lines in order to be able to detect the presence of the various constituents; the color, relative position, peculiar form, variety of shade, and brightness of the bands are quite characteristic enough to insure exact results, even in the hands of persons unaccustomed to such work. These outward distinctions may be compared with the differences of outward appearance presented by the various precipitates which we employ for detecting substances in the wet way. Just as it holds good as a character of a precipitate that it is gelatinous, pulverulent, flocculent, granular, or crystalline, so the lines of the spectrum exhibit their peculiar aspects, some appearing sharply defined at their edges, others blending off either at one or both sides, either similarly or dissimilarly, or some again appearing broader, others narrower."

Those who have ever been engaged in practical chemistry will remember the long,

* A milligramme is equal to fifteen-thousandths of a grain.

weary, and often fruitless labor of qualitative analysis according to the long-established methods of dissolving, filtering, precipitating, washing, drying, fusing, boiling, digesting, re-precipitating, re-dissolving, and so on, in endless succession. How charming to them will seem even the possibility of a process in which all this is dispensed with, and the slight trouble of reducing a substance to a volatile form, and then observing it through a telescope is alone required. It is as yet uncertain, however, to what degree of perfection and general application the process can be brought. That this same method of investigation can be extended to all the metallic elements is more than probable, for Kirchhoff writes to Professor Roscoe: "I have assured myself that even the metals of the rarest earths, as yttrium, erbium, and terbium, can be most quickly and certainly determined by help of the spectrum-analytical method."

It yet remains shortly to notice the most remarkable triumph which the method has achieved. In examining the spectra of the alkalies obtained from certain mineral waters, Bunsen observed the occurrence of two bright blue lines, which he had not seen before when he examined alkalies from other sources. Hence he concluded that these bright lines must be produced by a new, hitherto undetected, alkaline metal. Subsequent search proved the validity of the reasoning. The new metal was found, and isolated in sufficient quantity to demonstrate its individuality. Bunsen appropriately chose its name, *Cæsium* (*cæsius*, the primitive of *cæruleus*=bluish-gray), with regard to the color of its spectrum.

Again, more lately, Bunsen writes to Professor Roscoe:—

"The substance which I sent to you as impure Tartrate of Cæsium contains a *second* new alkaline metal. I am at present engaged in preparing its compounds. I hope soon to be able to give you more detailed information concerning it. The spectrum of the new metal consists of two splendid red lines, situated beyond the red line K. *a*, in the ultra-red portion of the solar spectrum. Hence I propose to call the new metal 'Rubidium.'" *

* Mr. Crookes, of London, has very recently announced his discovery of a further new element. It seems as if he would be Mr. Hind's representative in the chemical world.

Thus another instance is added to the list of those admirable triumphs of intellect, *verified predictions*. The memory runs back to Halley's Comet, to the discovery of Uranus, and afterwards the Asteroids, in accordance with Bodes' law of the planetary distances, to the determination of Neptune's position before he had ever been seen, and to the discovery of conical refraction by Sir W. R. Hamilton on *à priori* grounds. Nor would we omit from the list the very curious deduction of Young, Poisson, and Arago, that mercury has a refractive index of 5.829 out of air, though this fact never has, and never can be observed, owing to the opacity of mercury. In the science of chemistry the verified predictions have not previously been so remarkable, although analogy has often been confidently and safely trusted. The determination of the vapor density of carbon, from the law of combining volumes, is a prediction resembling the last mentioned, and probably incapable of direct verification.

By the new method of discovery now established, we almost fear that a list of new elements, diminishing in importance in a sliding scale, will soon be found. The severe dignity of a chemical element will then suffer in the same way that the solitary grandeur of the principal planets of our system has suffered from the asteroids, to which an addition, under the name of a new planet, is now made nearly every month. This is as bad as swamping the House of Lords.

Considering the extreme beauty of the process thus described, we have thought it a work of considerable interest to inquire how far the simple principle of spectrum-analysis had been previously entertained in theory. Thus, we propose to trace the history, not of the spectrum in its general bearings, but chiefly as regards the restricted truth, that *a given definite series of rays proceed only from a certain element, of which they may be used as a sure indication*. In doing this, we utterly disavow any intention of in the least disparaging the labors of the professors whose discoveries we are considering. If they were not chronologically the first to conceive the idea, they were the first and perhaps the only men who could turn it to so good an account. Professor Bunsen's researches are almost as well known in this country as in his own, and from the moment

of their publication become the models for all subsequent inquiries in the same subjects. If Professor Kirchhoff's name is here less familiar, it is only because his subjects of study are more abstruse, and less likely to draw the attention of a people who are *generally* practical in their pursuits.

The earliest observations we have found bearing on this subject were communicated to the Royal Society, in January, 1785, by the Rev. M. Morgan.* He examined by the prism the light of bodies in a state of combustion, and mentions the method as if it were nothing new; thus, "if sulphur or æther is burned, or any of those combustibles whose vapor is kindled in a small degree of heat, a blue flame will appear, which, if examined by the prism, will be found to consist of the violet, the indigo, the blue, and sometimes a small quantity of the green rays." He also alludes to a Mr. Melvill's mode of examining bodies whilst on fire by the prism, and the following sentence will prove interesting in regard to the history of the subject: "Mr. Melvill, when he made some of the preceding experiments, observed that the yellow rays frequently escaped in the greatest abundance; but this singularity proceeded from some circumstances which escaped his attention."† Although this same *singularity* occurred to all subsequent observers, the circumstances alluded to escaped detection until within five or six years of the present date.

Dr. Wollaston may doubtless be considered the first talented observer in this now important and fascinating branch of science. In the same paper in which he gives the first notice of Fraunhofer lines, he mentions that by candle-light a different set of appearances may be distinguished. Among these is *a bright line of yellow*. Again,‡ "when the object viewed is a blue line of electric light, I have found the spectrum to be also separated into general images; but the phenomena are somewhat different from the preceding. It is, however, needless to describe minutely appearances which vary according to the brilliancy of the light, and which I cannot undertake to explain." These last remarks lead us to reflect how short is the step in advance which the wisdom even of a man like Wollaston allows him to take, and how great the error of supposing that even the most apparently fickle phenomena of nature will not be reduced to law, and to some useful purpose, by due observation and reasoning.

Among Fraunhofer's observations * were some upon the colored spectra of flames and the Electric Light, which were published in a supplement to his principal paper.† He noticed a bright *orange* double line in the spectrum of a lamp, and found it to hold the place where, in the spectrum from sunlight, the dark line D stands. He also found this ray of light, which is, of course soda light, in the blowpipe flame, and suggested that this simple homogeneous light would be useful in many experiments. This idea was, about ten or twelve years afterwards, applied by Brewster in the Monochromatic Lamp. So far we find no hint of the principle of spectrum-analysis; but we come now to mention H. F. Talbot, the chief discoverer of photography, who, thirty-five years ago, recognized and announced the principle with considerable distinctness. The name will be familiar to many from the Talbotype process of photography having been named in his honor by Sir D. Brewster. In 1826 Talbot, at that time a member of Parliament, appears to have occupied himself with a set of rather desultory but clever optical experiments. He analyzed light from various colored flames prismatically, and in the spectrum of the light of deflagrating sulphur and nitre he observed a red ray, also presented by the flame of a spirit-lamp, whose wick had been soaked with nitre or chlorate of potash. He was now led to argue as follows:—‡

* Phil. Trans. vol. lxxv. p. 190.

† Ibid. p. 194. We know nothing more of this Mr. or M. Melvill, unless he be the same as T. Melvill, the author of a letter on the different refrangibility of the rays of light, in the *Phil. Trans.* for 1753, p. 261. The letter is dated Geneva, Feb. 2, 1753.

‡ Phil. Trans. (1802), vol. xcii. p. 380.

* It is of so much advantage to consult original writings, that we regret the difficulty under which most English readers lie in obtaining access to the memoirs of Fraunhofer and many celebrated continental observers. Fraunhofer's celebrated memoir, with his excellent map of the spectrum, is in the Munich Transactions (*Denkschriften der Academie der Wissenschaften in München für die Jahre* 1814–15, B. v.). A French translation is said to be in Schumacher's *Astronomische Abhandlungen*, 2 Heft, Altona, 1823. The Life of Fraunhofer, and some part of his writings, will be found in Brewster's *Edinburgh Journal of Science*, vols. vii. and viii.

† Translated in Brewster's *Edinburgh Journal of Science*, vol. viii. p. 7.

‡ Brewster's Edinburgh *Journal of Science*, vol. v. p. 81.

"This red ray appears to possess a definite refrangibility, and to be characteristic of the salts of potash, as the yellow ray is of the salts of soda, although, from its feeble illuminating power, it is only to be detected with a prism. If this should be admitted, I would further suggest, that whenever the prism shows a *homogeneous* ray of any color to exist in a flame, this ray indicates the formation or the presence of a definite chemical compound. An excellent prism is, however, requisite to determine the perfect homogenity of a ray."

The concluding paragraph of this paper is as follows:—

"The red-fire of the theatres, examined in the same way, gave a most beautiful spectrum, with many light lines or maxima of light. In the red, these lines were numerous and crowded, with dark spaces between, besides an exterior ray, greatly separated from the rest, and probably the effect of the nitre in the composition. In the orange was one bright line, one in the yellow, three in the green, a very bright one in the blue, and several that were fainter. The bright line in the yellow is caused, without doubt, by the combustion of the sulphur; and the others may be attributed to the antimony, strontia, etc., which enter into this composition. For instance, the orange ray may be the effect of the strontia, since Mr. Herschel * found in the flame of muriate of strontia a ray of that color. If this opinion should be correct, and applicable to the other definite rays, a glance at the prismatic spectrum of a flame may show it to contain substances which it would otherwise require a laborious chemical analysis to detect." (*London, March*, 1826.)

We do not find that he published any thing further on the subject until February, 1834, when he discriminates with considerable accuracy between two substances which have since proved so interesting in the hands of Bunsen. He says:— †

"Lithia and strontia are two bodies characterized by the fine red tint which they communicate to flame. The former of these is very rare, and I was indebted to my friend Mr. Faraday for the specimen which I subjected to prismatic analysis. Now, it is difficult to distinguish the lithia red from the strontia red by the unassisted eye. But the prism displays between them the most marked distinction that can be imagined. The strontia flame exhibits a great number of red rays, well separated from each other by dark intervals, not to mention an orange, and a very definite bright blue ray; the lithia exhibits one single red ray. Hence I hesitate not to say that optical analysis can distinguish the minutest portions of these two substances from each other with as much certainty, if not more, than any other known method."

It may seem surprising that Mr. Talbot did not follow up the principle which here so clearly suggested itself. To a French or German philosopher it would have afforded subject of assiduous study for years. Perhaps the want of an extensive chemical knowledge prevented him from seeing the whole value of method; but we think that it may have been the extreme delicacy of the soda-test, and the almost universal presence of soda which quite puzzled Mr. Talbot, and perhaps discouraged him from further prosecuting the method. Thus he found that perfectly clean platinum did not affect a flame, but after being touched with soap, or even with the finger, it produced yellow light. Wood, ivory, paper, and many other substances, when burnt, gave more or less of this yellow light, "which," he says, * "I have always found the same in its characters. The only principle which these various bodies have in common with the salts of soda is *water*; yet I think that the formation or presence of water cannot be the origin of this yellow light, because ignited sulphur produces *the very same*, a substance with which water is supposed to have no analogy."

Here was certainly a difficulty very *naïvely* and frankly stated, from which Mr. Talbot never extricated himself. More confidence in the principle he had formed would have led him to assert that, because soda-light appeared, soda must have been present, for this is exactly the principle on which Kirchhoff and Bunsen now announce to us the composition of the sun, and assert the existence of new elements before any one has seen them.

It is not a little curious that, about the same time with Mr. Talbot's experiments, two of the most distinguished physicists of this century, Brewster and Herschel, were likewise experimenting on colored flames, and both were led into similar error by this evil-disposed soda-light. Thus Brewster, in

* Edinburgh Transactions, vol. ix. p. 456.

† Phil. Mag. (3d Series), vol. iv. p. 114.

* Brewster's *Edinburgh Journal of Science*, vol. v. p. 79.

describing his Monochromatic Lamp for the illumination of objects in Microscopy, by which all chromatic aberration and indistinctness would be avoided, says :— *

It had long been known that a great quantity of homogeneous yellow light was created by placing salt or nitre in the white flame of a candle, or in the blue and white flame of burning alcohol. After numerous experiments, attended with much trouble and disappointment, I found *that almost all bodies in which the combustion was imperfect*, such as paper, linen, cotton, etc., gave a light in which the homogeneous yellow rays predominated; that the quantity of yellow light increased with the humidity of these bodies; and that a great proportion of the same light was generated when various flames were urged mechanically by a blowpipe or a pair of bellows."

Knowing, as we now do, that spring-water, rain-water, and even the air itself, are almost never free from traces of soda, the perplexity and despair of the acute Sir David, arriving at a climax in the bellows experiment, are not a little amusing.

Sir J. Herschel, † too, investigated the nature of these chemical colored flames; but the curved lines by which he represented the optical types or spectra of lime, baryta, and strontia, bear evidence that this most sound and excellent of natural philosophers was likewise in error about the soda-light. In the flame of sulphur violently burning he noticed perfectly homogeneous light, of a brilliant yellow color and strictly definite refrangibility.

It is curious to observe the very different use of these colored flames which suggested itself to Talbot and to Herschel. The former, calling optics to the aid of chemistry, proposed the method of prismatic analysis, now performing such wonders. Herschel was then an optical philosopher, calling chemistry to his assistance, and his thoughts accordingly took a very different direction. "It is needless," ‡ he says, "to insist on the advantage that may be taken of these and similar properties of colored flames and media in optical research."

The next allusion to spectrum-analysis is in 1835, when Professor Wheatstone presented a paper to the British Association, * "On the Prismatic Decomposition of Electrical Light," describing the spectra observed when the electric spark is taken between points of various metals. In the observations he employed a telescope, furnished with measuring apparatus. He determined that each metal present occasioned bands peculiar to its own spectrum, in perfect independence of any other metals, or of the medium through which the spark is displayed. "The appearances are so different," it is added, "that, by this mode of examination, the metals may be readily distinguished from each other."

In the next place, Dr. W. A. Miller, in the meeting of the British Association in 1845, described the prismatic spectra from flames colored by copper, boracic acid, strontium, calcium, and barium. No allusion is made to their analytical use, and the spectra, indeed, as given in a colored print, † present but little resemblance to what other observers describe. Perhaps the doctor had some solid substance present in the flame, and omitted to eliminate all rays that do not invariably accompany the element examined.

The "Études de Photométrie Electrique" of M. A. Masson now follow in the order of time, in the fourth and fifth parts of which ‡ he has described many most interesting observations. He examined the spectrum of the electric spark when taken in air between poles of various substances, as also *in vacuo*, in various gases, and in several liquids; but his results chiefly bear upon the nature of the electric current, and we do not observe any allusion to the principle of spectrum-analysis. As Herschel was absorbed by the optical interest of colored chemical flames,

* Trans. of the Royal Society of Edinburgh, vol. ix. p. 435.

† Ibid. 1823, p. 433.

‡ Trans. of the Royal Society of Edinburgh, 1823.

* We do not find that more of this paper was published than an abstract in the *Philosophical Magazine*, *a reprint* of which is all that appears in the Report of the Association! See Notices of Communications to the British Association at Dublin, August, 1835, p. 11. Masson, in a memoir afterwards referred to, also regrets his inability to learn more about Wheatstone's researches; and we must say that a large part of the Association's publications are perfectly useless for reference. The same is the case with the publications of the Association for Social Science. Abstracts have generally no value. (A fuller report of Wheatstone's experiments has, however, very recently appeared in the *Chemical News*.)

† Phil. Mag. (3d Ser.), vol. xxvii. p. 81.

‡ Annales de Chimie et de Physique (3), vol. xxxi. p. 295.

so is Masson absorbed by their electrical interest.

In the year 1852, Professor Stokes presented to the Royal Society his celebrated paper on Fluorescence, or "The Change of Refrangibility of Light," in which he devotes a section to "Optical Tests of Uranium in Blowpipe Experiments." *

Speaking of the phenomenon of internal dispersion in a bead of microcosmic salt fused with oxide of uranium, by which a curious green light is produced, he says:—

"When properly examined by means of sunlight, its sensibility is evident at once, and when the dispersed light is viewed through a prism, it is resolved into bright bands. . . . So delicate is this test when applied to uranium, that on one occasion, when engaged in examining a bead colored green by chromium, which had been fused in the exterior flame, I observed the appearance given by uranium. This turned out to be actually due to uranium, of which a mere trace was accidentally present without my knowledge."

He continues:—

"The green communicated to microcosmic salt by uranium, after exposure to the reducing flame, has a very peculiar composition, by means of which the presence of uranium may be instantly detected. For this purpose it is sufficient to view through a prism the inverted image of the flame of a candle formed by the bead, the latter being so held as to be seen projected on a dark object. The observation is perfectly simple, and occupies only a few seconds. The spectrum exhibits an isolated band at the red extremity, followed by a very intense dark band of absorption."

This refers only to light derived from internal dispersion, a peculiar source; but the generalization to light from other sources is now of course obvious.

Next in the order of time, we find that in April, 1856, Professor William Swan communicated to the Royal Society of Edinburgh some researches † "On the Prismatic Spectra of the Flames of Carbon and Hydrogen." He shows, as Fraunhofer indeed had originally shown, that several bright lines in the carbo-hydrogen spectrum coincide with dark lines in the sun, and argues in favor of some physical connection. He also proves, without using the prism, that a portion of chloride of sodium, weighing less than the 1,000,000th part of a grain is sufficient to tinge a flame with bright yellow light, and this quantity of salt contains only one 2,570,000th part of a grain of metallic sodium. And he adds:—

"When we consider the almost universal diffusion of the salts of sodium, and the remarkable energy with which they produce yellow light, it seems highly probable that the yellow line R, which appears in the spectra of almost all flames, is in every case due to the presence of minute quantities of sodium."

Swan, then, surmounted the sodium difficulty which had puzzled such men as Herschel, Brewster, and Talbot. The "circumstances" which produced the "singularity" noticed by M. Melvill in the middle of the last century did not escape him, and a considerable stumbling-block was certainly removed from the path of succeeding explorers. *

One of the most accurate and philosophical recent researches on the spectrum is that of A. J. Angström, † upon the electric light. Did our space allow, we should have been glad to notice his results for their intrinsic interest. We do not find, however, in his memoir the slightest allusion to the practical employment of the luminous bands for the detection of substances. He proves the singular fact that the electric light, besides lines peculiar to each metal, gives a multitude of luminous lines, comparable in number and distribution to the dark lines of the solar spectrum, and the *same for all metals.*

Although Talbot, Wheatstone, and Stokes saw the utility of the prism in detecting the presence of bodies, they presented no complete system of observation. Dr. J. H. Gladstone, however, adopting the principle thus established, carried it out into practice with great ability in one particular branch. ‡ He detects the presence of a substance in a clear solution by its power of absorbing certain rays of a continuous spectrum; in short,

* Phil. Trans. (1852), vol. cxlii. p. 522.

† Trans. (1856), vol. xxi. p. 411.

* Swan has since thought it worth while to claim any credit that this entitles him to (*Phil. Mag.* [4] vol. xx. p. 173), although the German professors duly acknowledged acquaintance with his research.

† Poggendorff's *Annalen*, vol. xciv. p. 141; or the *Lond. and Edin. Phil. Mag.* [4] vol. ix. p. 327.

‡ Quarterly Journal of the Chemical Society, vol. x. (1858), pp. 79–91, also p. 219.

he applies the spectrum to determine with more accuracy the characteristic color of a solution, and shows that the lines and bands thus observable are a perfect test of the presence of a certain substance. He also establishes from numerous observations, the important rule, recognized by nearly all investigators in this subject, that "all the compounds of a particular base, or acid, have the same effect on the rays of light." This method of absorption is applicable to a greater range of substances than Kirchhoff's and Bunsen's method; thus it may detect the presence of litmus and other organic colors. But it has none of the extreme delicacy, facility, and certainty which constitute the whole value of spectrum-analysis. Dr. Gladstone had not the good luck to choose the right branch of this inquiry; but his concluding remarks prove that he was fully aware of the value of the prism. They are as follow:—

"These observations will be sufficient to prove that the varying chromatic phenomena, exhibited by different substances, may be taken advantage of in qualitative analysis, to an extent which has been hitherto unappreciated. My remarks have been almost confined to transmitted light; but the phenomena of reflected light offer a similar, and as yet almost unoccupied, field of investigation. What I have here marked down must be considered rather as a tentative inquiry than as a really valuable contribution to our knowledge of the effect of different chemical substances on the rays of light; but should any one be induced to take up the matter systematically, he might easily make such a series of observations as would furnish data for regular tables of comparison; and the prism would then take its place, as the blowpipe now does, among the recognized and almost indispensable instruments of the analytical laboratory."

We should notice that Mr. Crookes and Mr. Pearsall have also, in particular cases, used the prism on the analytical principle.

From the preceding historical sketch it would appear probable that Talbot discovered the very method of analysis now performing such great things; that Wheatstone recognized the principle, and that Gladstone developed it into a complete method in one branch, which did not prove to be luckily chosen. To all the other inquirers on the subject, the utility of the spectrum in analysis seems not to have occurred. It would be superfluous here again to eulogize the achievements of the German professors, whose published results we are reviewing.

Some persons, we believe, consider it a trifling, if not an ill-natured, occupation to trace back the occurrence of thoughts and works which only, after a time, are recognized at their true worth. But the same principle might be applied to other parts of history. It amounts to saying, "Let bygones be bygones. We have a great deal of science and learning, and many pleasant things in the present day, and we shall not increase them by rooting up old records, and inquiring who secured these advantages to us." It must not be so; the very history of science is a science of itself, showing the gradual development of modes of thought, and the errors and difficulties into which genius falls are some of the most interesting facts in the range of knowledge.

But independently of this interest, we have a strong opinion that formal honor and, if possible, general reputation should be meted out to scientific men by laws as strict and impartial as those which secure the execution of a dead man's will.

In the first place, it is obvious that the human race owes to scientific discoverers a debt which it is not merely impossible to discharge, but even to conceive. Suppose Providence had decreed that Watt, instead of being plagued by patent laws, should have enjoyed a small percentage of the advantages which he has caused and will cause to others; how long the life, how great the benefits that would have fallen to his lot! Watt, indeed, was partly a practical man; but the same could be said of most abstruse philosophers. Again, it is, we believe, generally true that an earnest discoverer is never so well rewarded as when the worth of his results is proved and acknowledged, and the *expectation* of the proof and acknowledgment is nearly equal to the fact. What is wealth, or a title, or a splendid funeral to a man who has laid the foundations of a new science, knowing that it will grow through all time more perfect and useful, and bear his name upon its front? But the beauty and grandeur of the edifice will seldom be apparent in the few first stones, except to him who has the whole design mentally before him. So he who publishes a

single new and original thought may well know what it will grow to be, and yet feel that future times only will witness the growth. That a single thought may turn the affairs of men, no reflective person can deny. Every science, and consequently every material achievement of modern times, is the development of a few simple grand thoughts, apparently incidental in their occurrence, but generally the result of enormous labor. May there be none, then, who shall go without their due award of honor for any labor or ability which they apply to the advancement of the general good! Thus we shall best insure future energy. But in any case, let us remember the soliloquy of Falstaff: "Honor pricks me on. . . . What is that honor? Air: a trim reckoning! Who hath it? He that died o' Wednesday. Doth he feel it? No. Doth he hear it? No. Is it insensible, then? Yea, to the dead. But will it not live with the living? No. Why? *Detraction* will not suffer it; therefore I'll none of it."

We have but little space left to consider one obvious but exceedingly interesting application of spectrum-analysis; viz., to the determination of the chemical composition of astronomical self-luminous bodies. If we receive from a distant body rays of light, which, when examined by the prism, are found to correspond, to the utmost degree of accuracy that our observing powers can attain, with the light given off by sodium and calcium, here the induction is quite irresistible, that sodium and calcium exist in that distant body. It is possible that this direct mode of observation may be applied to the stars; but when we come to consider the sun's spectrum in this relation, a most remarkable phenomenon meets us. The bright bands of colored light observed in the spectra of sodium and the various elements correspond, not to bright bands in the solar spectrum, but to the dark lines long since observed by Fraunhofer. This coincidence is so striking in the case of the conspicuous line D corresponding to the line of the sodium spectrum, that Fraunhofer himself noticed the fact, as we have seen, and all subsequent observers have confirmed it. From this and other coincidences many natural philosophers probably had become convinced of a physical connection of the bright terrestrial and the dark solar lines. It remained, however, for Kirchhoff to show experimentally, as well as theoretically, the nature of this relation; and his results are published in the second paper at the head of this article.

Kirchhoff finds that any element in the gaseous state has the power both of radiating and absorbing light rays of those definite kinds which are shown in its spectrum. If, from its condition of heat, the light radiated is more intense than that absorbed, the body appears luminous; but if the rays falling upon it are the most intense, the body gives out less light than it absorbs. In the last case, the gaseous body will intercept light, or be opaque to rays of the definite kinds belonging to the gaseous substance. If, then, a compound ray of light containing rays of all kinds or color pass through sodium in a gaseous state, the yellow rays which belong to sodium are intercepted, and the spectrum of the compound light would be marked with a dark band, which corresponds in position to the line Na. a of the sodium spectrum, and the dark line D of the solar spectrum. It must be understood, however, that this line is only dark relatively to the rest of the spectrum, for the sodium vapor which is absorbing yellow light may be giving out yellow light of less intensity. What is thus shown in the case of sodium is obviously applicable to potassium, lithium, and all other elements, however complicated their spectra.

The fact of the absorption of definite rays by certain elements was proved in the most convincing manner by the following experiments:—

"The bright line produced in the spectrum of a gas-flame by the presence of a bead of chloride of lithium, is changed into a dark one when direct sunlight is allowed to pass through the flame. When the bead of lithium is replaced by one of chloride of sodium, the dark double line D (coincident with the yellow sodium line) appears with uncommon distinctness."

The same line D was also produced when light from a white-hot platinum-wire, which would otherwise give a continuous or complete spectrum, was passed through a flame of weak aqueous alcohol in which common salt was dissolved.

A still more striking proof of the same fact was shown in an ingenious experiment

by Professor Roscoe in his lecture at the Royal Institution (partially frustrated, however, by an unfortunate breakage). A piece of sodium was placed in a glass tube exhausted of air, and then heated until the tube was filled with pure sodium vapor. When viewed by pure yellow sodium light this tube appeared nearly opaque, while by all ordinary light it was perfectly transparent!

But how are the conditions of these experiments fulfilled by the sun? Kirchhoff makes the very reasonable assumption, that the central solid and fluid mass of the sun gives off light rays of every character, such as would produce a continuous and complete spectrum, like that of incandescent platinum, but that the sun's atmosphere contains the gaseous elements which absorb certain definite rays, and produce Fraunhofer's lines. By these processes of experiment and inductive reasoning, Kirchhoff has already proved that the sun's atmosphere contains, amongst other substances, sodium, iron, magnesium, chromium, and nickel, but that lithium is not present in any appreciable quantity.

Indeed, it wants little cool reasoning to be convinced of these statements when we see the spectra of the sun and of one of these elements side by side. Thus Professor Roscoe, in his lecture, eloquently described the indelible impression made on his mind by the splendid spectacle of the coincidence of the bright lines of the iron spectrum with a part of the dark solar lines:—

"In the lower half of the field of the telescope were at least seventy brilliant iron lines, of various colors, and of all degrees of intensity and of breadth; whilst in the upper half of the field the solar spectrum, cut up, as it were, by hundreds of dark lines, exhibited its steady light. Situated *exactly* above each of the seventy bright lines was a dark solar line. These lines did not only coincide with a degree of sharpness and precision perfectly marvellous, but the intensity and breadth of each bright line was so accurately preserved in its dark representative, that the truth of the assertion that iron was contained in the sun flashed upon the mind at once."

In the whole range of the sciences there will scarcely be found an experiment so intrinsically beautiful in itself, or so pregnant with interesting information, as this. By the aid of such experiments the chemist will not always grovel on the earth. Light has now become his servant, and will bring him telegraphic information for every part of space.

The present occasion is not quite the first on which our thoughts have been raised to the chemical composition of astronomical bodies. The aërolites which occasionally fall upon the earth's surface from the unknown regions of space have been found to contain in greater or less quantity many of the terrestrial elements, such as iron, nickel, manganese, chromium, cobalt, aluminium, calcium, magnesium, sodium, silicon, sulphur, carbon, hydrogen, and oxygen. No new element unknown to us here has been found in these aërolites; but at the same time no combination of elements, such as the aërolites almost invariably present, has ever been met with among the plutonic or sedimentary rocks of our planet. Light itself has previously been made to yield some slight information by observations as to its state of polarization.

It is very uncertain to what extent we may be able, by observing the spectra of the stars, to determine their chemical composition. A statement of Sir J. Herschel bears closely on this matter, and is not very encouraging. He says:— *

"Nothing short of a separate and independent estimation of the total amount of the red, yellow, and the blue rays in the spectrum of each star would suffice for the resolution of the problem of astrometry in the strictness of its numerical acceptation; and this the actual state of optical science leaves us destitute of the means even of *attempting* with the slightest prospect of success."

But in spite of this we entertain no doubt that every principal star will, in the course of time, be analyzed by spectrum observation, and that Bunsen will then be one of the chief founders of the Chemistry of the Universe, as he is already the chief contributor to the chemical geology of our own globe. In thus speaking we are not making random generalizations, but have facts to warrant what we say. Fraunhofer did not neglect the spectra of the stars, and has given us nearly the whole of the information we possess about them. In the spectrum

* Results of Astronomical Observations at the Cape of Good Hope, p. 304.

of Sirius he observed no fixed lines within the orange and yellow spaces, but in the green there was a very strong streak, and two other very strong ones in the blue. The star Castor gave a spectrum exactly like that of Sirius, the streak in the green being in the very same place. The spectrum of Pollux contained, besides many other weak lines, a line corresponding to that of D in the solar spectrum. The line D was also seen in the spectra of the stars Capella, Betalgeus, and Procyon. * But observations of this nature are surrounded with difficulties such as even Fraunhofer, with his incomparable prisms and lenses, could scarcely overcome.

The interest of this subject is immensely increased if we consider that the colors of the fixed stars appear even to the naked eye exceedingly various, pointing no doubt to great differences of chemical composition. Several astronomers, especially Sir John Herschel, Admiral Smyth, Sestini, and Struve, have devoted much attention to this subject. Admiral Smyth states, † as the general results of the surveys made, that of 2540 stars, the yellow stars are about half the total number, and equally distributed; the white stars are one-fifth, in scattered portions; and the orange rather more than one-fifth. The red or the blue are rare from the Pole to 30° of north declination; the blue then become numerous ($=\frac{1}{7}$) to the equator, especially from right ascension eighteen hours to twenty hours, and the red abound from 0° to 30° south declination and right ascension sixteen to twenty hours. Sir J. Herschel gives a list of insulated stars of a red color almost as deep as that of blood, and gives many interesting details concerning particolored double or multiple stars. He believes, however, that no green or blue *star* (of any decided hue) has been noticed unassociated with a companion brighter than itself. ‡

A solitary observation of the spectrum of a colored star, ζ Herculis, is recorded by Brewster, who, for this purpose, applied a fine prism of rock-salt to Sir James South's great achromatic refractor. He found there was one defective band in the red space, and two or more in the blue space, so that the orange color of the star arose from the greater defect of the blue than of the red rays. *

There can be little doubt that the predominance of yellow light in the heavens is due to the wide extension and powerful light-producing quality of sodium, especially as the spectra of Pollux, Capella, Betalgeus, and Procyon prove that this element exists in these stars. In Sirius and Castor we may assume that at least very little sodium exists. We shall be much interested to learn what elements produce the blood-red and the blue-colored light of certain stars. What if we should be enabled to map out, however imperfectly, the whole of apparent space of the heavens into regions of the metals, regions of the alkalies, regions of the alkaline earths! How astounding if we should prove the existence of globes composed of little else than copper, silver, gold, or platinum, just as there is some reason for thinking that our own system is chiefly composed of iron! We may even discover elsewhere elements unknown in these parts of space. All the sciences have their own peculiar beauties and delights; but there is nothing which raises such intense wonder within us as astronomy in its descriptive and chemical branches. The wildest fables of the *Arabian Nights Entertainments*, so far from being foolish in their extravagance, will appear weak and commonplace for the very opposite reason, when we come to read such descriptions of the physical constitution of the sun and stars as may, before very long, be expected. Just at the present time, the scientific world is awaiting the publication, not only of further researches by Kirchhoff and Bunsen, but of the result of the Astronomer Royal's expedition to Spain at the late solar eclipse. Hence it is only common prudence to avoid mere speculation on these subjects.

All discoveries concerning the spectrum have a very important bearing upon molecular philosophy. The definite rays in the spectrum of an element inform us most precisely of the vibrations of which the elementary atoms are capable. A complicated spectrum must indicate that the elementary atom is itself a compound of many simpler atoms; a suspicion of which fact has long been famil-

* Brewster's *Edinburgh Journal of Science*, vol. viii. p. 7.

† Ædes Hartwellianæ, p. 291.

‡ Outlines of Astronomy, 4th ed. p. 580.

* Prof. Swan appears recently to have made observations on this subject. In the Phil. Mag. (4,) vol. ii. p. 448, he describes a method of measuring the planetary or stellar spectra by a prism and common sextant.

iar to chemists, from the simple relation holding between the equivalent weights of several series of elements. Already some coincidences may be observed, which are probably more than accidental. Sodium which has nearly the most simple spectrum possible, is likewise distinguished by the fact that all its salts are soluble, so that its determination by ordinary analysis is difficult. Again, iron, which has an extremely complicated spectrum, has the most extensive family relations with the other elements. At the present time, mathematicians, electricians, opticians, chemists, and even physiologists, are united in one immense confederation, irrespective of nation or of language, for the purpose of solving the great remaining problem of natural science,—that of the molecular constitution of matter, and the mutual relations of the physical forces. If we consider the intense concentration of the highest ability and the most unremitting labor upon this subject in every branch, which this century has witnessed for the first time in the history of mankind, we cannot think that the solution is far distant. The second great step in our knowledge of the world will then have been made, comparable in importance and difficulty to the discovery of the differential calculus and the law of universal gravitation, achieved, however, by a whole army of thinkers and workers, not by a single intellect.

Mr. Murray has in press the second volume of "The Life of Lord Chancellor Shaftesbury," edited from unpublished family documents; the Lock papers, in the possession of Lord Lovelace, the Coventry papers, in the possession of the Marquis of Bath, from the French foreign office, the British Museum, and the State Paper Office, edited by W. D. Christie.

Messrs. Bell & Daldy will shortly publish "Bentleii Critica Sacra," notes on the Greek and Latin text of the New Testament, extracted from the Bentley MSS. in Trinity College, Cambridge. With the Abbé Rulotta's collation of the Vatican MS., a specimen of Bentley's intended edition, and an account of all his collations, edited, by permission, by the Rev. A. A. Ellis.

Another volume of "Answers to 'Essays and Reviews'" is to appear, published by Messrs. J. H. & Jas. Parker, to which the following reverend gentlemen have contributed: the Rev. Dr. Goulburn, the Rev. Dr. Heurtley, the Rev. Dr. Irons, the Rev. H. J. Rose, and the Rev. Dr. Wordsworth. The book will also contain a preface by the Bishop of London.

Messrs. Nisbet & Co. have in the press "The Experience of a Scripture Reader among the Collieries of South Staffordshire;" and "Black Diamonds; or, The Gospel in the Coal Mines."

In a manufacturing country where thousands of tons of waste products are being accumulated in mountains in every large chemical factory, the problem of the utilization of waste is of vast importance. M. Kuhlmann has just shown how the "soda residues" (oxysulphide of calcium), which have hitherto been of no value whatever, can be transformed into a very hard and durable plaster. He mixes together equal parts of these residues and the crude oxide of iron obtained in the combustion of pyrites. The mixture is moistened and ground up into a homogeneous paste, when it gradually solidifies in the cold to a mass as hard as a well-burned brick. On exposure to the air it becomes still further hardened, and becomes extremely sonorous. The color of the mass is of a reddish brown, like earthen pottery. This cement is said to stand the action of frost in a very perfect manner, especially if the surface be temporarily hardened by a wash of silicate of potash. If this cement were formed into bricks, they would doubtless be far cheaper than those in ordinary use. The best mortar for them would be some of the freshly ground paste before it has solidified. A wall built in this manner would ultimately harden into one solid piece, no portion being weaker than the rest. — *London Review.*

The performance of Moliere's *Tartuffe* has been interdicted at Lyons, France, but Count Walewski, who has authority over all French amusements, denies any complicity in the edict.

From Blackwood's Magazine.

JOSEPH WOLFF. *

THERE is nothing more usual than to say that the one thing wanting to the present age is that distinctness and originality of individual character which gives half of its charm to the past. Yet in spite of this general sentence of mediocrity, everywhere acknowledged, here has, within the last two years, a book slid quietly into print and out of it, without much notice taken of the matter, which no publication of the last two centuries, overflowing as they are with personal story and piquant character, has surpassed. There is, perhaps, scarcely a district in the country where the name of Joseph Wolff does not wake smiles and recollections, sometimes ludicrous and sometimes affectionate. For a man who has written next to nothing, and done not very much, in this country at least, the universal acquaintance in which the land of his adoption holds him is remarkable enough; but the book which friendly persuasion and help has drawn out of the old man, in his old age and leisure, is something still more remarkable. It is the story not only of certain *Travels and Adventures*, but of all the haps and mishaps, mistakes, successes, virtues, and follies of as odd and characteristic a figure as has ever appeared within the English horizon. Pepys himself, the prince of autobiographers, has not disclosed more naïvely his vanities and frights and compunctions; and among the world of books which everybody now-a-days knows by head-mark, and can classify without trouble, a book which is not a book but a personal narrative, is a prize which we seize upon with no small joy and self-congratulation. The reader of these volumes will find it possible to forget that he is not a *listener;* he will break upon the course of the tale, into applauses of laughter and admiration; he will discover himself gradually growing into acquaintance with the outlandish hero, who stands clear and full in the foreground, relating his own achievements with innocent relish and gusto, until at last, when the curtain drops and the story-teller is seen to sink into that bosom of domestic tranquillity, a Devonshire vicarage—most strange, incongruous, desirable resting-place after such a course—few, we predict, of those who have accompanied him to this climax of his days will part otherwise than as a friend from the Jew-traveller, the Eastern missionary, the English vicar, who has thus disclosed himself to their familiar regards.

We seize upon the book with all the natural delight experienced by a wayfarer making dull progress upon the beaten and dusty tracks of literature, who suddenly finds himself face to face with the unexpected apparition of a living human creature; not an abstract folio or quarto upon stilts, nor any light-limbed sprite of romance, but a solid —very solid—personation of flesh and blood, as real and visible a man as ever made his appearance upon any platform. There he stands in all friendliness, afraid of none of us—facing the shafts of criticism bravely—an obese but dauntless Sebastian. Any fledgling marksman who has the heart is free to aim his arrows at this unguarded and unsuspecting hero. He had clearly no such chance in his mind when he told, amid tears and laughter, the story here written down, by kind domestic scribes, of the long and various romance of his life. Not ours be that ungenial task. Few men have such a story to tell; few men have those qualities for telling it which alike make the narrative fresh, lively, and delightful, and lay the writer open to the ridicule of the cold-hearted critic. The two things are almost synonymous. A man who has no weaknesses is a poor autobiographer; even the most skilful of historians makes indifferent work of a piece of perfection. To our shame be it confessed, do we not all prefer Lancelot to the blameless king? and to descend to homelier matters, does not everybody know that all the virtues of the father or mother do not go to the hearts of their children, like those dear every-day foibles, familiar as their habitual dress and looks, which wake up the very tenderest of all home recollections? A man who writes his own life does not need to be a very profound or elevated character; but he needs to be a frank, honest, unsuspicious one—either unaware of his own faults, or possessed of human vanity enough to make him suppose everybody else as much interested in the explanation and excusal of his conduct as himself. Such a man is Dr.

* *Travels and Adventures of the Rev. Joseph Wolff, D.D., LL.D., Vicar of Ile Brewers, near Taunton, and late Missionary to the Jews and Mohammedans in Persia, etc.* Saunders, Otley, & Co. 1860.

Wolff. He assumes the interest of all his readers with such cordial heartiness that who would refuse to be interested? Behind the sympathetic domestic circle the good man sees only a sea of sympathetic faces repeating the expression there. He disarms the coldest spectators by his cheerful confidence. Such a story is not to be regarded as subject to formal examination, and amenable to conventional rules. It is, on the contrary, an altogether exceptional production. It is one of those tales for which we all yearn, children and grown people alike; a story which is true, and as simple as true, where the hero acts upon no rule, but does exactly as the spirit moves him—sometimes wisely, sometimes foolishly; where little events hold rank just as high, or by chance higher, than great ones; and where hosts of varied groups come and go without any serious bearing upon the tale, or necessity for a second appearance. For perfect reality and *vraisemblance*—for entire and simple-minded disclosure of character—for primitive interest and novelty, the very soul of story-telling,—we know no book of recent times which is fit to be compared with the Adventures of Joseph Wolff.

There are differences in autobiography as in every thing else. Joseph Wolff, still living, and displaying by the most distinct of all evidences (according to the newspapers) his intention to live, prints his innocent free-spoken memorials, frankly naming a world of people, and nobody is the worse for it. Another personal history which has attained greater note in the world than that of the venerable Joseph, the Life of the Inveresk Carlyle, comes to us, after a long lapse of years, carefully bottled up until everybody was dead who could be affected by it. This fact sets forth the difference between the two types of self-revelation.

After everybody has read his Autobiography, the world knows about just as much and as little of Dr. Carlyle as his ordinary acquaintances must have known, and as it was his will and pleasure to reveal; but with all the clearness of a photograph sees into his contemporary world, learns what other people were about, what manner of men they were, what were their claims upon the recollections of posterity, and what the failures to be recorded against them. It is not himself but his society that brightens upon the canvas—one sees the Edinburgh streets and closes, the Dumfriesshire roads and hospitable manses, the venerable precincts of Glasgow College, with a handsome figure passing out and in with handsome ruffles and an unexceptionable toilette. What the heart and soul of him are about meanwhile, Carlyle keeps to himself; and in the brightness of the reproduced scene, where the colors are all fresh as a Reynolds portrait, or as the Scotch Martin's transcript of the writer's own handsome face, we forget that it is other people we see, and not the autobiographer. Altogether different is the treatment adopted by Dr. Wolff. It is he himself who stands in the front of his picture; other people come in as accessories, as assistants in the conduct of the scene, as the audience who surround and listen to and applaud the principal actor. All that has to be told concerns "Wolff." He has no skill in stripping the interest from himself to some notable person about him, and so escaping unrevealed. On the contrary, the good man fully acknowledges himself the most interesting person present, knows that he can tell more about "Wolff" than about all the other people put together; and, feeling at home in that description, opens out into the full tide of narrative without ever flagging or growing weary of his subject. The remarkable people he encounters are only visible so far as they cross his own varying ever-active path; they never withdraw the interest into other channels, or break upon the unity of the picture. Here nobody will learn what was the aspect even of that limited and peculiar society into which the young Jewish missionary was received when he came to England. No sketches of his patrons or teachers are to be found in these lively characteristic pages. They come and go, but Wolff remains. He is in possession of the ground, and sees no reason to transfer his place to any other. The consequence is, that while the light falls only in momentary occasional glimpses upon those angles of other people which have come in contact with the hero, the principal figure stands out with all the breadth and fulness of life, round, distinct, and individual. The idea of posing his contemporaries in graceful groups, or throwing light upon the history of his time, never seems to have occurred to the ingenuous story-teller. Simeon, the leader

of modern Low-Church evangelicalism, a notable man, and one in whom any *genre* painter would delight, appears in Wolff's narrative in ludicrous simplicity only as attempting the vain task of teaching that Oriental to *shave*—an attempt which has never been successful, though renewed upon various occasions; and the other secondary figures in the story appear in a like innocent *abandon*, neglectful of all their individual claims to interest, solely at those points upon which they touch Wolff, and contribute to the progress of his full existence. Here the perfect prose of innocent fact has hit upon the highest art of the painter, or even of the tragic poet. Instead of the broken radiance of a gallery of pictures, one is presented to us, all sunny and smiling, with every accessory kept in the most artful, simple-minded subordination to the main action of the piece. The effect is inimitable. Your brilliant groups, dashed in with a flowing historic pencil, are on the whole, except at the first glance, not much more satisfactory than those blank pictures of a committee, or conference, or general council, where every face is a portrait, and where literal truth proves itself so false to nature, that nobody, save an adoring partisan, can look with any patience at the broken surface flecked with many faces, where neither unity nor grace can be. In each group of portraits the temptation to be concise and antithetical, to balance one character with another, and to make angles and circles of a regularity unknown to nature, is always apparent. But no such danger surrounds the single portrait. Here he stands, not requiring to balance himself against any other—not obliged to describe or set forth his own qualities in due bound and limit—beaming forth, large, round, and at his ease—certainly not a perfect, as certainly a most genuine, individual. It is very common to say that the sayings and doings of any man, honestly set down day by day, would make the most interesting of books. Never was there a greater fallacy. Not one man in a thousand has the art of showing himself through the envelope of his daily doings. The perpetual disguise in which most of us live, concealed even from ourselves, would make the record of our proceedings a most dry and lifeless skeleton of humanity. It is the rarity of the faculty which gives it so great a charm.

Here, however, is the one individual in a thousand—or say in a million, which may be nearer the truth, and a few ciphers more or less matter little—who can tell his own story. It is time to inquire what kind of a story that is which he has to tell. It is the story of a Jew, a native of Franconia, son of a German rabbi, who, stumbling into a perception of Christianity in his childhood, pursued the faint and doubtful light which had shone upon him through years of youthful, virtuous vagabondage, very amusing and curious to read of, living and learning somehow without any apparent means of doing either, among professed Protestants and genuine Catholics, among philosophers and infidels, monks and rabbis, not without glimpses of the greatest personages in Germany, till at length the lad found himself in Rome in the Propaganda, the idea of becoming a missionary having seized upon his youthful imagination. Out of the Propaganda he stumbled again towards Protestantism and England; went to Cambridge, where he learned many things, but not how to shave himself; and terminated this romantic and extraordinary youth by marrying the daughter of an English earl—a climax as romantic and unusual as the preliminary life. With this passport to the good offices of society, and apparently with hosts of friends attracted by his own genial simplicity, vanity, and honest qualities, he set out upon twenty years of missionary wandering amid the picturesque unknown races of the East, into deserts and dangers and troubles of all kinds, and sometimes to the very brink of death—out of which wonderful career the fortunate adventurer has subsided in his old age into an English vicarage, the strangest unlooked-for termination to a life so various; from the tranquil retirement of which he now sends forth this moving and eventful tale. By means of some missionary books of an odd and unusual description, by speeches and lectures, but, more than all these, by that subtle influence of reputation which carries the name of one man to the end of the world, while it refuses to bear the fame of another not less noteworthy beyond the place where he was born, the name of Joseph Wolff has become a household word to many people, in every quarter of this country which crowned his young adventurous life with such unusual fortunes. Such reputation

does not come for nothing; and in the book now before us Wolff has justified his fame.

Popular opinion now-a-days is as much divided in respect to the Jewish race as it has been in all generations. To some they are still the chosen people affectionately longed after, prayed for, and fruitlessly preached to; to others the meanest and least hopeful of people, remarkable only for that instinct of merchandise and money-making which has been the curse and the support of their race. Sidonia on the one hand, and the keeper of the sponging-house on the other, are only variations in the view. Christendom has resolved to observe no medium in her sentiments regarding this wonderful tenacious family. It is apparent that the popular judgment has but indifferent means of discriminating the highest character of these scattered Hebrews. We have ourselves heard a Spanish Jewess lamenting bitterly that it was a common error among the English to ignore the fact of any aristocracy among her people, and to believe that the Levys, the Mosses, and Cohens, and such usurious brotherhoods, were true representatives of a race which still retained patricians of further and purer descent than any Norman noble. This is doubtless a matter worth the consideration of Jew-despisers; but no vague conclusions on this subject will be half so effective as is a single glimpse into the home of the simple German rabbi, the minister of the little synagogue in the Bavarian village, where devout people gather in little groups to speak of that restoration to their own land which they are not sufficiently enlightened to doubt of—where the picturesque traditions of Jewish learning are the portion of the children, and where the pious regulations of life are such as these: "Say the blessing over every thing you eat; don't eat with uncovered head; go every day to the synagogue; never lie down without having said, 'Hear, O Israel, the Lord our God is one God.'" In such a house "young Wolff daily listened with the highest interest to the conversation of his father, when the Jews assembled in his house in the evening-time, and he spoke to them about the future glory of their nation at the coming of Messiah, and also about the zeal of many rabbis who had travelled to Jerusalem and Babylon as preachers to the Jewish nation." The rabbi then diverges into miraculous tales of the great Mymonides, of the holy Judah-Haseed, and finally of Jesus of Nazareth, about whose merciful and brotherly inclinations towards the Jews a curious Talmudical tradition is recorded. "This history made a deep impression upon young Wolff, so that he asked his father who this Jesus was. And his father answered that he was a Jew of the greatest talent; but as he pretended to be the Messiah, the Jewish tribunal sentenced him to death. Young Wolff then asked his father, 'Why is Jerusalem destroyed, and why are we in captivity?' His father replied, 'Alas, alas! because the Jews murdered the prophets.' Young Wolff reflected in his mind for some time, and the thought struck him, 'Perhaps Jesus was also a prophet, and the Jews killed him when he was innocent!'—an idea which took such possession of him, that whenever he passed a Christian church, he would stand outside and listen to the preaching, until his mind became filled with the thought of being a great preacher like Mymonides and Judah-Haseed."

While these cogitations were revolving in the child's mind, he was accustomed to make daily visits to the house of a neighbor, the village barber-chirurgeon, where he naturally repeated his Talmud stories, and blew his childish trumpet about the coming triumph of the chosen nation. While the little Jew made his simple brag of all that was to ensue upon the coming of the Messiah, the other children laughed and listened; "but one day," continues the narrative, "old Spiess, with his stern look, said to little Wolff, 'Dear boy, I will tell you who the real Messiah was: he was Jesus of Nazareth, the Son of God, whom your ancestors have crucified, as they did the prophets of old. Go home and read the fifty-third chapter of Isaiah, and you will be convinced that Jesus Christ is the Son of God.' These words entered like a flash of lightning into Wolff's heart; and he can sincerely say that he believed, and was struck dumb. No word came out of his mouth, but he went home to his father's house, and read the fifty-third chapter of Isaiah in Hebrew with the Jewish-German translation, and then said to his father, 'Dear father, tell me, of whom does the prophet speak here?' His father stared at him and gave no reply; and Wolff dared

not to ask him a second time, but went into another room and wept. And then he heard his father say to his mother, who was also weeping, 'God have mercy upon us! our son will not remain a Jew—*he is continually walking about and thinking, which is not natural!*'"

The young proselyte, of whom this remarkable account was given, was then seven years old!

At eleven, the young hero, tired of the little progress he made, set off for Bamberg to seek his fortune. "What will you become?" asked his father. He replied, "A physician and a preacher like Mymonides." The old Jews who were present stroked their hands over their beards and said, "Woe, woe, woe! Your son will not remain a Jew: he will be mixed with the Gentiles, and go the way of all the Gentiles." With the extraordinary self-reliant adventurous instinct of his race, little Wolff set out thus, not to return again to the paternal roof. He took farewell of the home which he seems never to have entered again, with a simplicity which shows such a premature entry into the world to be no such wonder among that peculiar people, and set out upon the battle of his life. A more wonderful example of the child-adventurer has seldom been recorded. He was but eleven, helpless and penniless. He was leaving not only his father's house, but his father's faith, and all he had been brought up to reverence; and he was in search of, not the scanty living which contents the little Savoyard, the only corresponding type we know, but learning, and a career more lofty than his father's. The boy did not stay long in Bamberg. He was sent out thence with a curse from the house of the relation to whose protection he had betaken himself, when his inclinations and purposes became manifest, and so wandered forth forlorn, a little pilgrim of learning and faith. Worthy this idyllic tale is the following beautiful episode:—

"Wolff left Bamberg without saying one word, and without a single farthing in his pocket, and travelled towards Wurtzburg. On his way, in a field he found a shepherd, who was a Roman Catholic, and he asked him if he might stay in his house for the night? The shepherd replied, 'Yes, my friend,' and brought him to his cottage. He then asked Wolff if he was a Roman Catholic? Wolff replied by giving him an account of his history; and after they had partaken of the frugal meal, the amiable shepherd knelt down with his family to pray the rosary; but previous to their commencing the prayer, the shepherd said, 'Let us pray five Ave Marias and one Paternoster for the good of the soul of this poor Jew, that the Lord may guide him to his fold.' They prayed five Ave Marias and one Paternoster, and in the morning, before Wolff left, the shepherd said to him, 'Friend, you are in distress; allow me to share with you what I have got. I will give you two florins, which will carry you well to Frankfort.'"

Thus Providence and tender charity helped the wandering child. He taught Hebrew for a short time in Frankfort, and then in Halle; and after many other adventures, passing amidst infidel Jews and rationalist Protestants, and through Weimar, where he came under the shadow of Goethe and his brilliant company, came at last to Christian baptism and to the Catholic world at Vienna, of which he gives an interesting account.

Out of the domestic heart of Judaism he leads us into the bosom of the Roman Catholic Church, not to gaze outside upon that wonderful hierarchy, as most Protestants do, but to behold its internal factions and divisions, and the thoughtful mind working out under its conditions, as under those of every other Christian corporation, the great problems of religion and life.

The world is full of observers whose capacity enables them to comprehend differences: it is a common gift with superficial persons of all kinds, and in every field of inquiry. To perceive the perennial never-failing agreements and accordances is an altogether different matter. When the Protestant foreigner suddenly finds himself in the incense-laden atmosphere of Rome—when he sees the twinkling altar-lights interposing between him and the day, and perceives the gleam of mystical vestments and crosses through the darkened air—it is not wonderful that he takes up with that general notion, and hurriedly retreating from the scarlet presence, concludes in his startled mind that here is still the one tremendous unity, against which free thought and private judgment made the most memorable outbreak that has happened in the history of man. It is difficult to contemplate the Church of Rome under any other

than this aspect of unity. To know that people dare think there—that parties rise there as readily as in other communities—that fierce polemics, fierce as if the disputants were in the fullest exercise of private judgment, flourish within that all-enclosing silent wall of separation, with its pretences of infallibility—strangely disturbs our preconceived notions. We all know, but do not remember, what half-revealed convulsions were of old within the bosom of the universal mother; and to find perennial Protestantism and Evangelism swelling within that obdurate old breast, holding ground from generation to generation, descending by the ordinary laws of spiritual inheritance in irregular but never-failing lines of succession, maintaining a perpetual protest, never silenced, and rarely interrupted, for the fundamental truths of Christianity, in opposition to all errors and innovations, is very startling and wonderful to the ordinary Protestant reader. That such is the case, nevertheless, all students must be aware. The history of the Protest within the Church of Rome—of those Christians of the Creed who, by some extraordinary capacity of human nature, which is among its deepest mysteries, say their Ave Marias without a suspicion of idolatry, and worship amid a multitude of saints the one Mediator only—would be one of the most remarkable of histories. Popular inclinations at present turn to the other side of the question, and Giant Pope has not lost his terrors for the English imagination at least. But it is confounding to those good orthodox notions of antichrist, in which most of us have been brought up, to recognize that indisputable element of Christian and Protestant life, which keeps its ground perpetually in the very bosom of the Church of Rome.

When Wolff went to Vienna, all wistful, young, and open-eyed, happily without any prejudices to one or the other side of the great army of Christendom, it was his fortune to fall between the two always struggling and contending divisions of the Church. He found there, as he might have found in the English capital, a High-Church party, a Neologist party, a Protestant, and a Popular. The leaders of the Catholic Protestants were "Johannes Michael Sailer, the Fenelon of Germany, and the great Frederick Leopold, Count of Stolberg. These united strict orthodoxy and attachment to the papal power with admiration for antiquity and the Fathers, firm adherence to the dogmas of the Roman Catholic Church, and belief in the miracles of that Church, with rejection of what is called 'pious opinion.' As, for instance, they rejected not only the immaculate conception of the Virgin Mary, but denied the necessity of asking the intercession of the Virgin or of saints, and their minds revolted at the notion of *worship* being addressed to any but the Most High." The Popular party was there, as everywhere, the romantic-fervid, the passionate-devout, moved as everywhere by a popular preacher of striking character, profound piety, and primitive life; but characteristically distinct so far from the English model of a popular preacher, that the Redemptorist leader added to the love of God that almost secular warmth of devotion towards the Blessed Mary, which has formed a singular compromise between earthly and spiritual love in many a monkish bosom. These antagonist elements confronted, combated, and modified each other in the German capital. Hoffbauer, the Popular leader, mediæval and ultramontane, mingled the gospel with the most devout and absurd of traditions, and scorned the very philosophers who admired and followed him; and Stolberg, the enlightened Protestant Catholic, when a sermon was read to him in which the faithful were adjured to pray to the Lord Jesus and to Mary, thundered out, "Blasphemy! this is not the teaching of the Church." Such a voice out of the very bosom of Popery is startling. The two parties were at active warfare, as if they had been parties in the English or any other Church; both of them enjoying equal liberty and advantages, even in a capital where concordats had reigned, and were again to reign; and neither the Inquisition nor any milder form of persecution seems to have threatened the leaders of this division of the Church, who were all devout Catholics, and maintained their doctrine to be no reform, but the veritable creed. Among such people the Jew-boy became any thing but a Papist. He records his own youthful *gaucheries* and levities with the raciest *nonchalence*. The avowal of his nation sent a whole town into hysterics on one occasion; and the perfect frankness with which he professed, or claims to have professed, his sentiments on all subjects,

seems to have had a piquancy and relish which delighted rather than horrified his strangely diverse entertainers. For everybody delighted in the charming young man. From the innocent vagabondage of his student life, the friendless and moneyless lad came aloft with a spring into the best society. To see and to embrace him were almost the same thing throughout his all-fascinating career. Without any visible interval he comes from the Hebrew teaching, by which he kept life and learning in him, to the intimate friendship of Friedrich Schlegel, of Count Stolberg, and of half the great people of Vienna. Everybody furthered and forwarded his aims; most people took him into their confidence; he received support and encouragement while he stayed, and, when he went away, sheafs of introductory letters, which made his path familiar ground. Making allowances for that vanity which our hero confesses, this is less unbelievable than might be supposed at the first glance. The young Jew was no shy genius, sensitive on the subject of his own claims to regard, but a most straightforward, light-hearted, self-confident mortal, aware of his own agreeabilities, and happily incredulous that anybody could resist them. His manner of conciliating the affections of Pope Pius VII., when introduced to him, is amusingly characteristic, and explanatory of his social progress. When the old pope and the young student had both done all that was proper, and the pontiff had even expressed gracious intentions towards the wandering Hebrew, our hero suffered his affectionate feelings to get the better of him. He was charmed with the mild countenance and soft voice of the reverend old man. "Wolff gently and caressingly patted his holiness on the shoulder, saying, 'I love your holiness! give me your blessing.'" Who could resist such an appeal to his affections? Certainly not a good-hearted old ecclesiastic, to whom the love of the young was the only permissible enjoyment of earthly love. Wolff got the pope's blessing and his special favor. He was installed in the Collegio Romano, and afterwards in the Propaganda, and his amusing heresies winked and smiled at as long as that was possible; and when Roman decorum and safety permitted no more toleration, the rash convert was smuggled off safely out of the papal dominions, and came to no harm. Altogether a picture of priestly indulgence not common in any locality, and doubly uncommon, according to all record, in the very court of Rome.

At the same time it must be admitted that these good priests had their patience tried with the unmanageable young Hebrew, whose tongue would not be stopped. During a lecture in which the bulls of the popes were cited as the ultimate authority, "Wolff at once took fire, and said before them all, 'Do you believe in the infallibility of the pope?' The professor said, 'Yes.' Wolff said, 'I do not.' He was at once surrounded by the whole college. Bonelli was especially indignant, and exclaimed, 'Bad and impious people seldom do believe the infallibility of the pope; but if you want to stay at Rome, drive away these iniquitous thoughts, *scacciate questi pensieri cattivi!*'"

The ingenuous narrative proceeds: "Wolff became furious, but has since confessed that he did not show the real spirit of Christianity in the opposition which he offered. Nay, he owns that it argued a great deal of vanity in him, as a young man, to attempt to be a reformer. He ran to Cardinal Litta, and told him the dispute he had had, and that he did not believe the infallibility of the pope. Litta's conduct was most delightful. He showed the meekness of an angel, merely saying, 'My son, do not dispute, I beseech you, with these hotheaded young men, for if you dispute I cannot protect you; and you will be persuaded of the pope's infallibility when you hear the reasons.'"

This mildness, however, was without effect upon the incorrigible youth. He kept his protectors in perpetual hot water, though at the same time overflowing now and then in splendid religious projects, which procured him renewed affectionate messages from the amused but gracious pope. He disputed right and left with youthful pugnacity, and, to the annoyance of his Protestant as well as Catholic friends, let nothing escape him which he could make an exception to. Amid the alarm of his friends, however, he himself seems to have enjoyed the whole matter mightily, and found the Propaganda a most agreeable dwelling-place, made only more piquant and exciting by the continued warfare which he maintained, and the turning out, or worse, which inevitably awaited him. The yearly display of learning at the great missionary college was a scene entirely after

his own heart. "Wolff spoke in five languages, and chanted so that the hall rang," says the delighted autobiographer, warmed with the very recollection of his early achievements, "and all the auditors were in raptures, and applauded him; and the Italian collegians of the different colleges present kept saying, 'Look at him; what tremendous eyes he makes! *Guardateli, Guardateli, gli occhi che fa!*' After the whole was over, the servants of the cardinals, together with their masters, slapped his back and said, '*Per Bacco! che voce! che occhi!*'"

But in the mean time his bold heresies grew worse and worse. It was not, alas! out of pure regard for the truth that the rash young knight-errant rushed into the field so often. "Wolff confesses frankly," proceeds the candid tale, "that his grand enemies, all through life, have been vanity and ambition, cherished and encouraged alike by injudicious friends and covert foes. He owns that, during his life in Rome, his vanity made him believe that he knew every thing better than those by whom he was surrounded, and as people told him he was like Luther in personal appearance, he resolved, if possible, to be a Luther also in his stormy and wild career; while at the same time his insatiable ambition made him wish and aim at becoming pope, as he once openly avowed in the College." He had gone so far as to choose the name by which he was to be distinguished during his pontificate, and to confide it to his fellow-pupils, who doubtless received the confidence with screams of laughter. The young Jew was to be Hildebrand II., to abolish celibacy and the worship of saints! No wonder they found him rather a dangerous inmate of the polyglot community in the Piazza di Spagna. He rushed into correspondence with heretics at the same time, wrote letters to the distinguished English traveller, sworn friend of all eccentric beliefs and persecuted souls, the late Henry Drummond — to Bunsen, and other dangerous individuals; a correspondence none the less delightful, doubtless, that it ran risks of being intercepted, and was so in reality. When affairs had come to a crisis, a solemn secret visitation of a tailor, shoemaker, and hatter, was paid to Wolff in the seclusion of his own room. It was the seal of his sentence. Clothed in the mysterious lay garments thus mysteriously concocted, he was set out of Rome, under an escort of Carbinieri, and in charge of a messenger of the Inquisition, but only to be safely deposited in Vienna unharmed, and not much discouraged. The whole story is whimsically simple and amusing. The parlous boy had clearly overtalked and overcrowed himself, and his kind priestly protectors, to whom it must have been a blessed riddance, let him off with a few days' fright. How the provoking young disputant came out of Rome, and from the hands of an inquisitor, with any life left in him, would have been a standing marvel to Exeter Hall, had the young adventurer lighted in that locality. Let us recommend this story to the careful consideration of all theological paladins of twenty. One can imagine a Scotch student in similar circumstances, without the ingratiating vanities and oddities of the Jew, making himself profoundly detestable, and procuring a more summary and less easy expulsion; and who is there who has not encountered somewhere a delightful undergraduate, whom it would be but too great a happiness to introduce to "that member of the Inquisition," to the darkling tailor and mysterious shoemaker, who shuffled this intolerable lad out of his Propaganda gown — and into a new region as far distant as possible from the alarmed well-wishers, who could bear no more of him?

After this notable event the young Jew took to wandering once more, quite unaware what to do with himself, but apparently not much oppressed in his mind on the subject. He fell into a course of monasteries, among which he found, here a community of Benedictine friars, Protestant and Neological, there a learned Orientalist, lost in study of the Apocalypse, and coming to just such conclusions as Wolff himself afterwards came to amid the Protestant sages at Alburg. Unexpected meetings and sudden appearances of the very, most necessary, and desirable person at the most appropriate moment, have been discarded from fiction as unpermissible, and branded with all sorts of ugly names. But the fact is, as everybody knows, that in real life such things *do* happen, like many other things which nobody dare hint at in imaginary composition. When Wolff was about at his wits' end, and making no progress, he encountered a friend of his friend Henry Drummond's, and was forthwith conveyed

to England—to the guardianship of that singular and distinguished man.

Here his readers might have been well pleased had the autobiographer paused to tell us something of one of the most remarkable men of his generation. Henry Drummond has not, otherwise than in his speeches, —those speeches which people of all politics and ideas read with equal interest and amused regard, not for the subject of them, but for the speaker,—left any worthy record of himself to the world in which he played so notable a part. A long, busy, useful, and virtuous life has come to a termination, and the figure of a man lately holding so characteristic and separate a place in the home landscape—one of the country's independent advisers, certain to take his own view, and no other man's, and to give his counsel strenuously on every matter of national importance—already detaches itself in historic completeness from the phantasmagoria of facts and politics. Henry Drummond entered life with a rare portion of all the gifts of Providence. He was rich, he was of good family, with talents much above the ordinary proportion; a clear head, a warm and not too wise imagination, a liberal heart. All these gifts, while still a young man, he was led to devote to the service of that Master who had endowed him so plentifully. In the history of religion everywhere for the last fifty years his name is constantly appearing. Wherever faith was stirring among the dead continental churches — wherever Christian enterprises were setting forth—wherever serviceable men were to be had for these labors, or devout ones sheltered from persecution or poverty,—the sound of his name is like the apparition of the Eastern potentate in a tale of the *Arabian Nights*. Prompt, unhesitating, *rich*—holding that talisman of wealth which becomes in such hands a most enviable and magical possession, and is travestied entirely out of the vulgar thing it so often is, the rapid and bold energy of his individual hand has already revealed itself in many a book and many a history of lesser men than himself. Minds so one-sided, and yet so many-sided, are of the rarest. He embraced, with all the force of a single pursuit, the peculiar religious life which he and others finally consolidated into that which they themselves would not have permitted to be called a new sect, but which common phraseology knows no other name for; but while rapt in a mystic atmosphere of revelations and communications from heaven, and even himself, in all his acute intelligence and high-minded honesty, the medium of such, never lost for a moment his firm footing on the outside earth, his keen observation of mundane matters, his humor, his temper, his shrewd sense, and notable individuality. A man more utterly contemptuous of humbug perhaps never existed. If, by some strange chance, he was in some respects the victim of it, the marvel is one of the least explanable in nature. We remember his aspect in his later years with an equal degree of astonishment and admiration—the vigorous unclouded age which belongs to good British blood, and that noble patrician training in which no country in the world can equal England—the cool, clear, caustic understanding, sharp and vivid—the faith, a world beyond all reach of reason, profound, unquestioning, not to be shaken even by absurdity—a junction impossible, but apparent—a harmonious man blended out of the two elements to common vision most inharmonious and contradictory. Such as Henry Drummond was, no poor man could have been. His wealth was a part of his character. It gave him the promptitude, the readiness to do, while others talked—the inclination towards the impossible which was apparent in him. Nothing was difficult to such a man. By the extreme range of his own powers beyond the grasp of most of his fellows, his very opinions must have been influenced, and miracle itself appeared a less violation of nature. Impatient of delays and doubts, he bids Wolff no longer mind the Missionary Society. "*I* will send you out," said the arbitrary splendid rich man. The speech was characteristic. He appears with all the swiftness of an individual irresponsible agent wherever he makes a public appearance. In Parliament always delivering Henry Drummond's views, and no party's or clique's, and listened to as Henry Drummond with a closer interest than any mere political leader; and in all the other manifold paths by which a life so proudly silent as to its own doings, crossed the less reticent paths of other men, always the same independent self-responsible potentate: among the men of his time one of the most remarkable, whose name, in all probability, is to be

left in the keeping of tradition, but whom immediate posterity, at least, is not likely to forget.

In the hands of this independent prince in the religious world, the young man was soon under-weigh, and fully started upon his career. The life he had chosen from his earliest days, the life of a wandering preacher and missionary, had now begun, and the remainder of the book is taken up with a minute yet always fascinating narrative of his travels, his arguments, his sermons, his successes—all the daily drawbacks and furtherances that happened to him in his various journeys, occupying some twenty years of his life. To follow him in detail through this unexampled course—into all the wastes and all the civilizations of the East—among tribes whose very name is unknown to most readers, and through all the ever-changing crowds, picturesque, curious, and warm with primitive wonder, who throng round him wherever he goes—would be impracticable, and is not necessary. But it is impossible not to feel that the whole question of missionary enterprise is opened up in a new light by such a story as this. Nothing can be more utterly distinct from the ordinary forms of missionary labor than this mission of the fervid Jew. He goes out in apostolical freedom, as he tells us the missionaries of the Propaganda are sent, *cum omnibus facultatibus apostolicis*, without any *tether* by which the "Parent Society" may haul the truant in, should he exceed his prescribed course. He goes, remaining nowhere long, like a brisk wind among the dead apathies of Jew and Mohammedan; he passes on, a disturbing influence, rapid and all-enduring, from city to city and over the burning wastes. What he has to say must be said soon, for there is little time to lose, and the very arrival of the extraordinary wanderer wakes up the community he seeks, and prepares it for the brief but hot conflict—the burning, sudden message of the wayfaring man. Rumor, that surest of primitive messengers, blows trumpets before him which echo deep into savage wastes, far beyond the reach even of his courageous steps. He goes like an ambassador, an office comprehensible to all, propounding his message everywhere, and leaving that royal proclamation he carries to work its own way into the hearts of men. Certainly such a mission must commend itself to many who cannot fully enter into the ordinary fashion of missionary labors. The good preacher who toils his way to one spot in the wilderness—who carries with him the women and children of his household, trusting them, with a faith which, whether wise or not, is full of homely sublimity, to the protection of God—deserves the respect of all Christian people. But when our hearts are torn by sad tales of the disastrous, tragic conclusion of such an expedition here and there, the question will arise, whether it is after such a fashion that the gospel can be most fitly carried through the world.

Not many years ago the religious world was thrilled by the dreadful tale of a little brotherhood of martyrs who perished miserably on the savage Patagonian coast, subdued by the terrific climate, the want of necessary helps to existence, the fear of the disgusting savages round them, and if not the neglect, certainly the most apathetic delay of the society which had sent them forth. Though they had all the consolations of martyrdom in their own pious spirits, and left behind them the most touching records of the love that is stronger than death, it is impossible to use any other words. As men they perished miserably, without any price for their lives—shed their blood for naught—and *wasted*, though with the sublimest tragic prodigality, that zeal and those services for which the Church has so much need. Another domestic tragedy, involving women and innocent children, has just happened under very similar circumstances in Africa. We are aware that such calamities have invariably the effect of stirring other devoted minds to rush into the same dangers on the same spot; but that does not affect the real question. There is scarcely a preacher in Christendom who finds it easy to deliver a reckoning of what he has done in his charge or to show to visible earthly eyes what results have followed his ministry; but a preacher who calls together, day after day, his wondering congregation of indifferent savages—who has to watch their curiosity die out, and no other sentiment take its place—who has to convince minds that do not know what conviction means, and to awake affections which do not exist;—with, all the while, amid all the anxieties of a family to be kept alive and out of danger, a report to make to his so-

ciety, and visible tokens of progress to provide for their satisfaction,—is he the modern model of that ambassador for Christ who shall evangelize the world? Certainly Paul's labors were of a different fashion. The question is one of profound interest and importance. There are few people now-a-days who can content themselves with believing that it is no kindness to bring the heathen world under the responsibilities of the gospel; and at the same time there are many who, in spite of the most serious sense of the value of missionary labors, find it impossible to satisfy their minds with those anxious records of the work that is doing in a hundred far-separated corners—those long details of here and there some individual man or woman of whom the harassed missionary is hopeful, or that scanty tale of conversions, which in strange contradiction to the modesty of nature, are reported as so much value for their money to the subscribing home-community. A troubled half-guilty sense that there is something wrong in this system pervades many pious minds, who are in many cases driven to conclude that the wrong must lie in their own want of spiritual appreciation. To such the very possibility of an apostolic wandering must be consolatory; and we are much disposed to believe that the sudden visit of an evangelist, who must be gone suddenly again to bear that same message further—who is visibly come for no other cause—whose message so burns within him that he passes from place to place to deliver it, as a matter too momentous and precious to be confined to one quarter, and who, having left that seed, of all other seeds the most fruitful and undying, departs under the imperative call of that necessity which every savage can understand, of bearing the tidings of life and death to another and another place, till power and capability fail him—is of all other the means most likely to come at the primitive heart. By such means the early disciples made their way over the little world then known to man, and every picture of the wide heathen wilderness which surrounds Christendom seems to point out more and more clearly the value of such a knight-errantry for the work of the Christian Church.

The aspect altogether of the primitive mind, which knows little, which retains all it comprehends, and which is accustomed to transmit such corners of truth and knowledge as it has obtained through a hundred subtle channels of personal communication, which we, all-boastful of our press and print, have lost the gift of, is but slowly comprehended by the mind of civilization, penetrated, sodden as it is with perpetual instruction. Amid all the compensations of nature, none is more remarkable than this wonderful power of transmitting, which in actual truth does not leave us so very much to boast of in telegraphs and universal bookdom. "It is a remarkable fact," says the narrative before us, "that when Wolff returned to Mount Sinai, fifteen years afterwards, the very children who were not born at his first visit knew not only Joseph Wolff's name, but the names of his companions; and also that one of the ladies (i.e., a woman in a Bedouin tent) had taken his neckerchief. They knew, too, that Wolff had a servant called Franz Six, and that his companion Cann had a servant called Michael: also that whilst Wolff was always afraid that his servant was starving himself to death, the rascal, in fact, was drunk from morning to night. From this we see how these sons of the desert hand down the slightest events from father to son. The same peculiarity is found in respect to much more important matters. Wolff himself and other travellers light here and there in the most unexpected wilds upon some solitary man or woman hugging to their solitary hearts a bit of gospel they have found or heard by some chance means, and leavening with the half-known truth a secret corner of the desert; and "broken lights" from such imperfect centres gleam over all that mysterious East which still throbs with sacred tradition. Then, in those far-distant, unexplored regions, the Christian adventurer here and there falls upon a tract in which he can recognize the footsteps of a Christian and civilized man, and the trail of doubtful light still lingers on the way. The conclusion may easily be drawn that, while it is impossible to put the entire world under such close training as might be given by permanent missionary residents maintained everywhere, nothing can transcend the uses of the Christian adventurer, the wandering evangelist. He who but pauses on the wing to say what is in him, all urgent and in haste—he who possibly may never be seen again—the man who, for an hour or day's speech of the won-

dering community, has crossed hill and seas —he whose errand must be attended to at once or lost forever—has all the liveliest faculties of human nature enlisted in his favor; and of all mental phenomena there is nothing so remarkable as the tenacious life of truth when left to itself, even in the most unhopeful locality. Unnursed and unfostered, incomplete and fragmentary, that divine thing lives, and shines out in glimmers among the darkness. In those far Eastern lands, so dark to a cursory vision, such gleams are trembling about many an unsuspected centre; and it is no small testimony to the services of this autobiographer to say that he has shown under that heathen gloom a tremulous illumination of tiny lamps, imperfect but genuine. Infinitely better comfort than that which lies in the anxious schemes of visionary men to make out that we are but threatened a little in this existence to be all saved somehow at the last, lies in the sight of such unthought-of approaches to the God who sees better than we do over all the dim earth.

It was on such a mission that Wolff penetrated into the mysterious East. With dauntless simplicity he sought out his own people wherever they were to be found. From the merchant Jews of Malta and Gibraltar to the mystic and bemused rabbis of Jerusalem, he hesitated nowhere. With the one he maintains lively controversies ending in nothing, and with the other descends into the obscure lore of the Talmud, always fighting bravely, sometimes triumphant in argument, sometimes worsted, yet always persuading his antagonist of that one fact more potent than any argument, that *he believes*. It is said that this, of all others, is the question of which Jews are sceptical, and the missionary is again and again assailed by confidential invitations to disclose the hypocrisy of his Christianity, and winks and smiles of intelligence, for which an Englishman would certainly have knocked down the rogues who made them. Wolff refrains from all such personal demonstrations, but he does what is more, knowing his sacred office—he declares his faith with unvarying insistence, which at last brings tears into the eyes of his questioners. More than once, at the most perilous crisis of his fate, he is entreated to permit himself to be called a Mohammedan, but at absolute peril of his life nobly refuses, and declares his trust in Christ sufficient to support him through all dangers. At the same time he neither is nor pretends to be brave. He will venture to mount no animal above the condition of a donkey or broken-down horse, screams with fright when he crosses a river, and makes ridiculous exhibitions of panic when he is in the hands of sufficient protectors, all which he relates with great glee and perfect simplicity. But when the Eastern wanderer has to fight his way through an Arab tribe, or out of the hands of a dangerous unmanageable chief, the scene changes entirely. The coolness with which he prepares for that doubtful combat, the calm confidence with which he plies the quips of Oriental trickery to mystify his opponents, the lightheartedness with which he picks himself up, and with feet bleeding from the bastinado, or in stark nakedness, escaped with nothing but his life, sets his face still forward, though at a snail's pace, shames even English courage. One of these escapes, and the manner in which the clever Jew overcame the danger which threatened him, is well worth quoting. He was travelling from Bokhara to Cabul, and had to pass through the dominions of the governor of Moyam, who had already murdered some English travellers, and against whom he had been repeatedly warned.

"Wolff therefore proceeded towards Moyam, which is about eight miles' distance from Balkh, and as he crossed over a bridge he met a fine-looking tall Osbeck on horseback, who was a haji and a moolah, and was well acquainted with Arabic. Wolff conversed with him in Arabic, and he invited Wolff to be his guest for the night with his whole party, which offer they accepted; and in token of friendship, Wolff and the Osbeck placed the palms of both their hands together, and stroked their respective beards. 'There,' said Wolff, 'are we brothers now?' The Osbeck replied, 'Yes, praise be to God.' Then Wolff said, 'I will not deceive a brother. I tell you, therefore, who I am. I am an Englishman. Will you protect me?' The Osbeck clasped his hands above his head in despair, and exclaimed, 'As long as you are in my house none can touch you; but the moment you leave it, the governor, who is my cousin, will send after you and put you to death. Therefore you must promise to do what I tell you. You speak Arabic, so I will introduce you as an inhabitant of Mecca, and tell my cousin when he comes that you were once my host in Mecca,

and then he will ask your blessing and depart.' Wolff answered, 'I shall do no such thing. All I order you,' and, he added, turning round to his followers, 'and you also, is not to say one single word about me when he comes; but refer him to me, and I shall answer all his questions to his entire satisfaction, not hiding any thing from him.' With this understanding the Osbeck took Wolff to his house. In the evening came the governor, as the Osbeck had said; and seeing Wolff, he came straight up to him, and asked him, 'Where do you come from?

"*Wolff.*—'From Malta.'

"*Governor.*—'What town is Malta?'

"*Wolff.*—'Noah had three sons, Shem, Ham, and Japheth. Ham had again a son, whose name was Canaan. Malta was peopled by the descendants of Canaan (because they are descendants of the Phenicians).'

"*Governor.*—'Whereabouts is Malta?'

"*Wolff.*—'The contrivances of man and their inventions for their conveniences are wonderful; but every nation has its own ways. Here you have boats made of skins. At Malta are boats called *steamboats*' (Wolff gave him the English name, for of course the governor could not tell whether it was English or Chinese), 'and these are dragged on by smoke, which makes a whirring noise' (here Wolff imitated the noise), 'and entering such a boat, one reaches Stamboul from Malta in four days.'

"*Governor.*—'Who rules in Malta?'

"*Wolff.*—'The name of the governor is Ponsonby Khan, son of Besborough Khan, and his wife's name is Amalec Khatoon' (i.e., Emily the lady), 'daughter of Bathurst Khan.' It is to be remarked that Wolff pronounced these names in a broad Eastern way, and with a powerful voice.

"*Governor.*—'Where were you born?'

"*Wolff.*—'Here we must go to the Holy Book, the history of the world.'

"But here the governor became almost impatient, and exclaimed, 'This man is too learned for me!' and he seemed inclined to depart. But he came back, and Wolff began to read from the tenth chapter of Genesis, second verse. . . . 'I was born in the land of Ashkenaz,' which is the Hebrew name for Germany, which, however, Wolff did not explain to the governor. The governor was perfectly satisfied with the whole of this information, and said, 'Verily thou art full of truth, and there are no lies in thee.'"

This successful hoax, however, though it rid him of one dangerous adversary, did not bring him to his journey's end in safety. After a few days' further course, the unfortunate traveller fell into the hands of a fierce tribe of sectaries, known by the name of Kharyn, or "seceders from all the rest," who chose to object in the extremest way to the title of *Hajee*, by which his servants addressed him, and would let him off with nothing less than abjuration. His rational proposal that they should withhold the title from him had no effect upon those optimists. Only Mohammedans were entitled to use it, and a Mohammedan he must declare himself.

"'You must either say,' they declared, '"There is God, and nothing but God, and Mohammed the prophet of God," or we will sew you up in a dead donkey, burn you alive, and make sausages of you.' Wolff said, 'There is God, and nothing but God, and Jesus the Son of God.' They at once now gave a sign, and all their moollahs assembled in a large cave, hewn out of the rock. The Affghans who accompanied Wolff, as well as his three servants, trembled with anguish, and said to him, 'Say the Creed, and the moment you are on your journey again, you may just be what you were before.' Wolff replied, 'Leave me, and let me alone. I will manage them. All you have to do is to disperse, and leave me only with my three servants. Some of you go towards Kondoy, but don't go far.' Wolff then ordered his servants to bring him his writing-desk. They did so, and he wrote the following words:—

"'*To Lord and Lady William Bentinck.*

"'MY DEAR LORD AND LADY WILLIAM BENTINCK,—The moment that you read this letter, you must be aware that I am no longer in the land of the living; that I have been put to death. Give to my servants some hundred rupees for their journey, and write the whole account to my wife, Lady Georgiana. —Your affectionate

"'JOSEPH WOLFF.'

"Wolff gave this paper into the hands of his servants, and said, 'Now I will make one more attempt to save my life. If I succeed, well; if not, go on as far as Loodhiana, and the first red coat you see, give it to him, and he will bring you to the governor-general, and you will be rewarded. Now, bring me my firmans from the Sultan of Constantinople.' They did so; and Wolff, with the firmans in his hand, entered the cave where the moollahs were seated, with the Koran open before them, declaring that he must be put to death. Wolff said, 'What humbug is this? You cannot dare to put me to death. You will be putting a guest to

death.' They replied, 'The Koran decides it so.' Wolff said, 'It is a lie! The Koran says, on the contrary, that a guest should be respected, even if he is an infidel; and here, see the great firman which I have from the Schalif of the whole Mohammedan religion from Stamboul! You have no power to put me to death. You must send me to Mohammed Moorad Beyh at Kondoy. Have you not seen how little afraid I am of you? I have told the Affghans already that they should disperse, and probably some of them have already gone to Kondoy.' When they heard the name of Mohammed Moorad Beyh they actually began to tremble, and asked Wolff, 'Do you know him?' As Wolff could not say that he knew him, he replied, 'This you will have to find out.' They said, 'Then you must purchase your blood with all you have.' Wolff answered, 'This will I do; for I am a dervish, and do not mind either money, clothing, or any thing.' And thus Wolff had to surrender every thing. Oh, if his friends in England could have seen him then, they would have stared at him. Naked, like Adam and Eve, and without even an apron of leaves to dress himself with, he continued his journey; and as soon as he was out of sight of the Hazara, he witnessed a sight which he never thought to have seen among Mohammedans. All his Affghan companions knelt down, and one of them, holding the palm of his hand upwards to him, offered up the following extempore prayer:—

"'O God! O God!
Thanks be to thy name!
That thou hast saved this stranger
Out of the lion's den.
Thanks, thanks, thanks
Be to thy holy name;
Bring him safely back
Unto his country,
Unto his family.
Amen.'"

Such startling incidents did not discourage the bold missionary. He went on through all those savage extremities, indemnifying himself by the flatteries and kindnesses of every little nucleus of Europeans he lighted on, and recording, with the kindliest warm-hearted, barefaced vanity, the laughing adulations addressed to him. "Wolff, your amiable conduct will carry you through the world," says one of his early friends; and though the candid story-teller confesses frankly that public opinion was divided as to his eloquence in refined Calcutta—the *Bengal Hurkara* describing him "as an amiable enthusiast, but not eloquent;" another Anglo-Indian journal praising only his "zeal and good-humor;" while "the paper called the *Englishman* cut Wolff up in a most tremendous and very clever manner"—yet the invariable observation of the Persians on hearing him was this, "It is astonishing how, and with what precision, Wolff conveys his ideas on religious subjects; for though he pronounces the Persian with a foreign accent, yet he rivets the attention of every one of us."

In propounding his millennial opinions, "Wolff did it with such modesty that he gained the affection of all," and expounded the eleventh chapter of the Romans to a poor old man, who had sunk into unbelief, in such a manner that "Botta confessed cordially that Wolff had beautifully shown him that the great apostle had combined in himself in a most prominent manner the philosopher, the religious man, and the divinely inspired apostle. Botta thanked Wolff most coddially for his masterly exposition; and wherever Wolff has expounded that chapter, whether to a philosopher or a religious man, a like observation has been made to him." Whenever he reached civilized ground, all the alleviations which kind women and friendly men could render him were lavished upon the well-pleased missionary, who comforts and excuses himself for all the amusing stories and records of his own social powers, which are interpolated into the narrative, by remembering that Francis Xavier also was "the life of the company" whenever he made his appearance in the secular world. His social qualities, however, never interfere with his work; and if the good man looms large through a mist of laughter, in many cases with an aspect more amusing than refined, he is as picturesque a figure as could be desired when he goes with the mournful Jews at Jerusalem to chant at the ruined wall of the Temple that pathetic song of woe and anticipation which the Christian Hebrew can still enter into with all his heart; or sits at the gate of the Eastern city, in the very face of Islam, and chants aloud the Psalms of prophecy—a proceeding the temerity of which strikes his English friends who have seen him "shake in his shoes" for the slightest gale with utter astonishment. The fashion of his courage was different from the ordinary development of that quality, and was not inconsistent with arrant cowardice,

according to his own confession—yet was notwithstanding, when necessity urged, a most sustaining and veritable valor.

The last great act of his life was the singular chivalrous enterprise, undertaken in a forlorn hope of saving two victims of Eastern ignorance and cruelty, Stoddart and Conolly. With a characteristic touch of superstitious friendliness, Wolff recalls to his mind that in all his disasters he has been delivered by *British officers*, and, inspired with the recollection, full of pity, vanity, affectionate regard, and confidence perhaps excessive, but entirely just, in a knowledge of Eastern ways which few living persons could equal, set out to Bokhara on the forlorn hope of delivering those captives. Trusting to his quick wit and old experience, and to the effect which his clergyman's gown, doctor's hood, and shovel hat, and the title of "Grand Dervish of England, Scotland, and Ireland, and of the whole of Europe and America," which he meant to assume, would have upon the ignorant and brutal court of Bokhara, the good man went forth in full canonicals, with a Bible, English and Hebrew, open in his hand, into the jaws of the lion. A most notable, vain, generous, and noble enterprise, which did not save the already murdered victims, but which must commend Wolff to every man who has any thing of the Quixote in his veins—as most men have whose good opinion is worth asking. Though he escaped by the merest hairbreadth himself, he overawed the savage potentate into an inquiry whether he had power to raise the dead?—a striking confession of remorseful fright and compunction. The Grand Dervish, however, found it difficult enough to accomplish his own escape, and all but testified his "gratitude to British officers" with his blood. By diligent use of all the devices common to captives, and by firmness and self-possession, he did at last manage to get away from Bokhara, and, coming home by a devious course, enlivened by many of his old experiences, came finally to England, and received from some confiding patron the living of Ile Brewers, in Devonshire. He had held a Yorkshire curacy before setting out upon his journey, touching which Mr. Drummond wrote him with all the frankness of friendship, "Your call is to be an evangelist for all the nations of the earth, and for this you are fit; but, to use your own simile, 'you are as fit for a parish priest as I am for a dancing-master.'" Most people, we presume, on *a priori* evidence, and judging from the nature of things, would be disposed to agree with Mr. Drummond. A parish priest, however, the Grand Dervish has been for fifteen years, and in that position has built a church, parsonage, and schoolhouse, increased his acquaintance to a large extent, and evidently, by the testimony of the preface and execution of this very book, won the love of his neighbors, whatever his parishioners may have to say. In this calm refuge reposes still the most notable of wandering Jews. How he confines his restless activity, his adventurous spirit, his love of frolic and commotion, into the restricted life and narrow limits of the vicarage, we will not undertake to say. The cage into which he has thus cooped himself, however, has evidently not broken his spirit. He seems to have retravelled all his various adventures with the highest relish and enjoyment; and we know no book of recent times that will stand comparison with this original record. The story overflows with character, humor, acuteness, sense, and folly—the most *naïve* and unreserved self-disclosure.

If Dr. Wolff was a romantic hero, or the brightest type of a wandering apostle, we might indeed object to many matters which hold a place in his narrative. But he is neither one nor the other; and what he does not consider beneath his dignity, we, the well-pleased recipients of his confidence, are not called upon to consider in such a light. All the vague reputation in which his name has been wafted abroad, will be vindicated by his own honest out-spoken tale. He is not a heroic personage, but he is the most lighthearted and dauntless of adventurers—the most amusing of companions. Dipping at random into his stores, it is quite uncertain whether you may light upon a broad modern joke or a quaint Oriental legend of primeval antiquity. His peals of comfortable complacent laughter—the laughter of a man fully satisfied with himself, and enjoying his own jests—are interrupted by wild chants of the desert, and pathetic Hebrew lamentations, pealed forth in a voice that has made itself heard among the clamors of savage tribes, and caused the halls of the Propaganda to ring again. Altogether the book,

which is not free from vulgarities, or even a suspicion of tediousness, in the latter part especially, has a fascination quite irresistible. We know neither priest nor traveller of modern times worthy to compare with this son of Levi and the desert—this wandering cross-bearer—this Grand Dervish of Christendom. It would be hard to light upon another Wolff; to look for such exceptional irregular personages would be foolish, and to find them undesirable. Nevertheless, there is in his mission a precedent which we would gladly see followed. A man of higher strain might make that sublime which Wolff has made interesting and exciting; and we cannot doubt that the flash of this passing visitor through regions of obscurity will throw farther reflections than anybody dreams of—reflections in all probability more original, and therefore more lasting, than those which are likely to arise round the permanent glimmer of some single stationary taper planted alone in the wilderness.

Opinion formed of Washington by Louis Philippe.—When M. Guizot had completed his "Study of Washington,' he sent a copy to the king, who thanked him in the following letter:—

"My dear late Minister,—If I have so long delayed my reply, it is because I wished to thank you myself for your work on Washington, and to tell you how much I should be gratified if I could command time to read and talk over it with you. You know too well how completely I am deprived of these tranquil relaxations. Nevertheless, I shall endeavor, at least, to read the introduction, which I hear spoken of as a masterpiece. My three years' residence in America produced an important influence on my political opinions and judgment on the march of human events. The puritanic and democratic revolution, vanquished in England, and driven for refuge to the little States of Massachusetts, Rhode Island, and Connecticut, overflowed and subdued all the other elements of population in the vast continent on which the European tempest had impelled it. For, although the Dutch at New York, the English Catholics under Lord Baltimore at Baltimore (1632), and, earlier than either, the French (under Henry IV.), had attempted this great colonization, all were extinguished under the puritanic democracy, and the fragments of the *Long Parliament* and its army. But Washington was neither puritan nor aristocrat; still less was he a democrat. He was essentially a man of order and government, seeking ever to combine and use to the best advantage the often discordant and always weak elements with which he had to combat, and to rescue his country from anarchy. I feel convinced that you have drawn him thus, and my confidence on this point adds much to my regret at not having time to read your Washington; but it always gives me pleasure to repeat the assurance of my sentiments towards you."

Photographs in Natural Colors.—M. Nièpce de St. Victor, who is so well known for his researches in heliochromy, has succeeded in producing colors of great brilliancy, and with a greater degree of permanency than has hitherto been obtained. The colored images, it is said, will resist the action of strong sunlight for several hours. It is assumed that the pictures in natural colors will in every particular be true to nature, with all the harmony of hues and tones, and with due graduations. We know from past experience that a very little success goes a great way when photography in natural colors is concerned; but if M. Nièpce succeeds in obtaining the promised result, it will be indeed a wonderful achievement.

The astronomers of Germany intend to meet at Dresden, on August 20 and 21, to discuss the distribution of observations of the stars—fixed, nebulous, and variable; also an arrangement for observing and calculating in a systematic manner, for the future, the movements, etc., of planets and comets.

Messrs. Longman have in the press a treatise on "Reading, Writing, and Arithmetic, and how they may be successfully taught in Elementary Schools," by Mr. Robert Floyd.

The first part—from Abraham to Samuel—of the Rev. A. P. Stanley's "Lectures on the History of the Jewish Church," is announced.

Mr. Bentley is about to publish a "Cook's Guide for the Middle Classes," composed by M. Francatelli.

ENGLISH SYMPATHY FOR PROF. LONGFELLOW.

Our readers will all welcome the words of touching appreciation with which the *London Star* announces the sad bereavement of Professor Longfellow. "One who has given," it well says, "so many bright gleams of happiness and so many impulses of elevating emotion to all the reading public of his own land and of Europe; one who has written so many lines of exquisite poetic beauty and refined tenderness of feeling, deserves, at such a crisis in his life, the sympathy of the world." —*Transcript.*

"In the recent news from America—among the brief telegraphic accounts of skirmishes which have taken place, and announcements of battles and campaigns which are expected—appeared one small scrap of melancholy intelligence having no relation to any warlike scene. Few Englishmen or Englishwomen who read at all can have seen without very deep regret the few words in the telegram which announced the heavy stroke of fate just fallen upon Henry Longfellow. We have received only some few particulars, but the precise manner in which the catastrophe took place is of little import. Professor Longfellow's wife has just been snatched literally from his arms, by one of the most terrible deaths a human being can die. The unfortunate lady was burned to death, and the poet himself, in striving to rescue her from the flames which enveloped her, sustained in his own person some severe injuries. The character and the celebrity of the man who has suffered this peculiarly terrible infliction remove the bereavement which has fallen upon him out of the range of mere private calamities. One who has given so many bright gleams of happiness and so many impulses of elevating emotion to all the reading public of his own land and of Europe; one who has written so many lines of exquisite poetic beauty and refined tenderness of feeling, deserves, at such a crisis in his life, the sympathy of the world.

"Into how many saddened hearts have not the words of Longfellow poured consolation? How many mourning eyes have not looked up with a brightening hope from the pages in which he had written such hymns of resignation—such cheering and strengthening appeals? A singer, whose lips breathed purer and sweeter inspiration, is not known to our present literature. No American writer, except perhaps Washington Irving, has ever made himself so broad a way into the popular English acceptation as Longfellow. Thoroughly domesticated in England, his works have long been, as the works of a foreign author scarcely ever were before. Some of our own great writers are far less familiar to general English readers. We remember hearing an American once remark that he met with more copies of Elizabeth Browning's poems in Boston than in London; and more of Longfellow's works in England than in the United States. England may claim the credit of having first recognized the peculiar qualities of beauty, feeling, and quaint thought which distinguish the exquisite prose-poem of 'Hyperion,'—a romance with which the name of the lady just dead was connected in the public mind in a manner now most melancholy to recall.

"We are only repeating what has been stated more than once in print, and what certainly was believed in Heidelburg, the scene of the leading portions of the romance, when we say that the wife of Professor Longfellow—she whose sad death we have just learned—was the Mary Ashburton familiar to the readers of 'Hyperion.' The life romance which the poet so exquisitely pictured, and which was believed to have had a climax of poetic fitness and happiness, has now found its mortal conclusion in an event which no one can think of without a shudder. 'The setting of a great hope,' writes Longfellow himself in the romance we speak of, 'is like the setting of the sun.' But the sun of the poet's hope has set in gloom sadder and darker than that which belongs to ordinary calamity. To have lost such a companion must, under any circumstances, have been to a man like Longfellow a blow which only the best resources of Christianity could enable him to bear with resignation. But to have lost a precious life by such a fate and for such a cause—to have seen the object of love and the source of happiness destroyed at once by a flame from a morsel of sealing-wax ignited in sport to amuse a child—must indeed increase beyond any power of words to describe the bitterness of the calamity.

"The number of women whose lives have been sacrificed during the past few years by the sudden meeting of flame and floating drapery, would form a long and an appalling record. It has been culminated for the present by the death of the wife of one in whose sorrow Europe and America at least feel the deepest sympathy."

OZONE.

VERY slowly, and in a tottering, uncertain manner, do we become acquainted with the mysteries hidden in apparently the most simple substance. The discovery of oxygen was one of the first fruits of modern chemistry; and after its properties have been seemingly investigated scores of years ago in the most exhaustive manner, we are just beginning to find out how utterly ignorant we are as to its real nature. A substance which is the very breath of life for all created beings on the earth, the consumption of which, to supply respiration and combustion, amounts to more than seven millions of tons weight per day,—forming three-quarters of the animal kingdom, four-fifths of the vegetable kingdom, half the mineral kingdom, together with one-fifth of the atmosphere and eight-ninths of the water on the earth, constituting, in fact, nearly two-thirds of our globe, and endowed with properties more strikingly remarkable than any other body in nature,—certainly offers some inducement for the earnest inquirer to explore its mysteries; and if we now feel so ignorant on the subject, it is not on account of the little that is already known, so much as the vast regions of unexplored wealth of which we have recently caught some faint glimpses.

In connection with the most wonderful, as well as the most fascinating, branch of this inquiry,—the mysterious power which oxygen, ordinarily quiescent, possesses of splitting up into two intensely energetic oppositely endowed *halves*,—the name of Schönbein will always be remembered. The untiring manner in which he investigated the subject of ozone,—tracking it from the *electrical smell* through all its phases, patiently working on in spite of the ridicule with which it was, up to a very recent time, the custom to assail him as the philosopher with one idea, the man with an ozonic monomania, and ultimately forcing the subject, by its very importance, before the notice of physicists,—is a worthy model for every young experimenter. Through him we have been led to ask whether the so-called chemical elements may not, after all, be mere allotropic conditions of a few bodies?—whether the speculations of the alchemists upon the mutual convertibility of the metals into each other, may not prove ultimately correct, and, in the language of Faraday, to view their fundamental doctrine of transmutation as no longer opposed to known analogies, but only some stages beyond the present state of knowledge.

It has at last become the custom to record ozone observations at most of the meteorological observatories, and the scientific and general public are pretty well aware that these indications afford a rough but on the whole a reliable test of the healthiness of any particular locality. The usual way of preparing the test papers for ozonimetrical purposes has been to soak fine paper in a mixture of starch and iodide of potassium dissolved in water. Upon drying, the paper was cut into slips, and the rapidity of its darkening, or the intensity which it acquired, in any given time, was compared with a numbered scale and recorded—the indications ranging from one to ten. Two errors are liable to creep in when the ozone papers are used in the ordinary way. They are usually suspended freely in the air, and exposed to light. Air is of course necessary, as the ozone is an ingredient of the atmosphere; but light causes the papers to fade, and thus destroys the indications. The other objection is that the papers are liable to be darkened by other bodies in the atmosphere—nitric acid, for instance, which is known to be present in quantity after thunder. The former difficulty has been overcome by Mr. E. J. Lowe, who has contrived an ozone box, which is simple in construction, small in size, and cylindrical in form; the chamber in which the test slips are hung being perfectly dark, whilst at the same time there is a constant current of air circulating through it, no matter from what quarter of the compass the wind is blowing. The air either passes in at the lower portion of the box and travels round a circular chamber twice, until it reaches the centre (where the test slips are hung), and then out again at the upper portion of the box in the same circular manner, or in at the top and out again at the bottom of the box.

The second difficulty is not so readily got over; but from some recent researches of Schönbein it seems probable that the substance known as pyrogallic acid will answer the desired end. He has just found that when a strip of paper, moistened with a solu-

tion of pyrogallic acid, is introduced into an atmosphere containing ozone, it is rapidly darkened; whilst, if no ozone be present, the paper retains its original whiteness. Schönbein therefore suggests that unsized paper, moistened with a solution of pyrogallic acid, would form a good test for the presence of this form of oxygen. This would seem to be a far better test than that in which starch and iodide of potassium are used. Nitric acid in the atmosphere would not be likely to have any action upon it; indeed, every photographer is in the daily habit of mixing pyrogallic and nitric acids together without any discoloration taking place. There is only one slight drawback, and that is, that long-continued action of strong ozone has a bleaching effect; this, however, would not be any disadvantage in practice, for a paper would never be exposed so long to atmospheric influences for this reversed effect to take place.

We do not know a more valuable or instructive study than that of the ever-varying quantity of ozone in the air. A test for this body ought to be as common in a house as a barometer. Ozone is equivalent to health. In crowded cities or unhealthy neighborhoods it is scarcely ever to be detected; whilst on the ocean, the seashore, or elevated, open tracts of country it is almost invariably present in quantity. The first outbreak of an epidemic is always heralded by a rapid decrease of ozone in the atmosphere, whilst its re-appearance is almost as certain a sign of the cessation of the sickness.

CHRISTIAN CONSCIOUSNESS.—If one truly loves God, he has the witness of the Spirit within him, and cannot doubt the reality of this Christian consciousness. More abstruse evidences of the reality of the new birth may be overlooked, if one can say, like the blind man, "One thing I know, whereas I was blind, now I see." *The Home Circle* has a pleasant illustration of this, told by Rev. Mr. Martin, of an eminent Southern statesman,—

"On one occasion, while the late Hon. W. C. Preston was an inmate of my family, I had been from home several days, and on my return, my little boy, Henry (then in his seventh year), as was his wont, manifested great joy on the occasion; so much so as to attract the attention of my honorable friend, who said to the little fellow:—

"'Henry, do you love your father?'

"'Yes, sir,' said Henry.

"'Are you sure you love your father?'

"'Yes, sir, I am sure I do.' And by way of proof the little fellow kissed me.

"'Henry,' he still asked, 'do you know that you love your father?'

"The little fellow was puzzled for a moment, but recovering himself, replied with evident feeling,—

"'Yes, sir, I know it, for I *feel* it'—and again he threw his arms around my neck, and kissed me.

"My friend was amused; so were we all; but there, as far as we knew, the matter ended. Colonel P. was at that time an earnest seeker after the truth, and two years afterwards, when nearing the eternal world, having made his peace with God, and realized the power of converting grace, as he lay calmly waiting and patiently suffering the will of God, he said to a friend, in speaking of his confidence in God:—

"'I am like a little child with his father—like little Henry Martin—I know that I love God, and am in his favor, because *I feel it—I feel it.*'

"Truly his confidence was simple and childlike, his humility deep and genuine. He loved God—he *felt* that he loved him; and in this peaceful frame of mind he continued most of the time, until his happy spirit took its flight to the bosom of his God. He had long been an inquirer after truth, and the simple remark of that little child furnished him with an illustration of the spirituality of religion; that it is something that may be experienced, that may be felt. He sought it and found it, to the joy of his heart and the salvation of his soul."

MESSRS. LONGMAN & CO. will publish immediately a "Manual of Moral and Metaphysical Philosophy," by the Rev. F. D. Maurice. Also, "A History of Learning and Literature in England," by George L. Craik, LL.D., Professor of the English Language in Queen's College, Belfast.

THE second edition of Henry Chorley's "The Authors of England," will be ready early next month.

From The London Review.

SOUND RECORDING ITSELF.

Among all the marvels of mechanical ingenuity which are being daily brought to perfection, none are more interesting than those which aim at the accomplishment of some task apparently requiring intellect, in addition to mere mechanical dexterity, for its execution. It is difficult to conceive a mechanical operation which requires a greater exercise of intellect than that of verbatim reporting by means of short-hand. Yet even this art seems likely, before long, to be supplanted. For several years a French savan, M. L. Scott, has been engaged in experiments on the fixation of *sound* upon a prepared tablet, in the same way as photography fixes luminous images; and has met with considerable success in this new art, which he has named Phonautography. At the last sitting of the French Academy of Sciences, a short communication was made by the discoverer in consequence of the publication of some experiments in the same direction made by other gentlemen. This communication was devoted chiefly to a description of certain illustrations laid before the members, and would be unintelligible to the general reader without the diagrams, and a knowledge of what had previously been accomplished by Mr. Scott. The subject, however, being of immense importance, and likely now to attract great attention, and having ourselves watched its development for several years, as well as having had many opportunities of inspecting the phonographic representations of sound autographically recorded by Mr. Scott's instrument, a short account of what has already been done by this physicist will perhaps be considered of interest.

The problem which first required solution was the artificial construction of an ear, by means of tubes and diaphragms, so as to imitate, as nearly as possible, the human ear in its power of collecting sounds of every degree of intensity, and transmitting them to a delicate membrane placed at the extremity. After numerous essays an apparatus was constructed which possessed the above qualifications; the membrane was seen to vibrate visibly, and in a different manner, with each audible sound or note; and if a pen or style were fastened to this membrane its point would trace the wonderfully beautiful and complicated curves and circles appertaining to the elements of sound. The next difficulty consisted in finding a sensitive surface upon which this style could mark the imprint of its movements; for the vibrations of the aerial pen were so delicate that if any appreciable force were required to effect the transcription, the resistance would at once stop all movement. This difficulty was at last overcome by employing a strip of thin paper, upon which was deposited a film of lampblack obtained from the smoke of burning bodies. This sensitive surface is carried along by clock-work agency, in front of the vibrating style, so that the successive movements of the latter shall not impinge one on the other, when the result is a series of lines written on the paper, composed of the most complicated systems of curves, and forming a natural autograph of the producing sounds.

Of course it will be understood that the above is intended more as a brief outline of the principal of Mr. Scott's instrument, than as an exact description of its individual details. In reality, especially in the one recently made, it is far more complicated than would be imagined from this brief sketch; but the phonographs produced by it are marvellously perfect. Every separate source of sound has an individuality of its own. The sounds of different musical instruments, for instance, are easily distinguished from one another, and from the human voice. This latter, moreover, gives different traces, according to its character,—the sweet, soft voice of a female, especially when singing, being characterized by great beauty and harmony in the curves impressed on the paper; in those produced by the harsher voice of a man, the curves are larger and more rugged looking; whilst in a shriek or a shout, or in the harsh, discordant sounds of instruments, the waves are irregular, unequal, and broken up into secondary vibrations of all degrees of amplitude.

An oration, delivered with varying rapidity, and with the pitch of the voice greatly modulated in different parts, has a very striking appearance in its phonograph. Rapidly spoken parts have the curves crowded together, whilst in others they are widely separated. The loud tones of the voice are

shown by the written waves rising to perhaps half an inch, or more, in height, whilst the low tones are not more than the eighth of an inch high; the modulations of the voice are thus shown very beautifully by the varying height of what may be called the letters of sound.

Thus, then, the problem of the graphic fixation of sound may be considered as accomplished; but now a new difficulty arises —that of translating these ever-varying curves back again into ordinary language. If each word or syllable, or even compound sound, of which our spoken language is built up, were invariably represented by the same system of curves, the work of transcription would be comparatively easy. This, however, is far from being the case. Not only does the impression vary with the tone of the voice, the rapidity or loudness of utterance, but it has been found that the same words uttered by one person are written down by the instrument very differently from the way they are when spoken by another; just as the handwriting of one person differs from another. This, however, is a difficulty which will be overcome by practice, and perhaps improved instrumental arrangements: even now we hear that Mr. Scott is attaining some facility in reading off these natural stenographs. The difficulties, however, in the way of fluent transcription into written language are very great, as the student in this new language has so many different forms presented to him as the equivalent for the same articulated sound; the tracings not being either a true synthesis of the words, nor a purely conventional sign like writing, which has, let us remember, no phonomenal value, but is merely, to use a mathematical expression, a function of the tone, the intensity, and the pitch.

The fact of being able to make spoken sounds record themselves permanently on paper is of itself most singular and astonishing; but if it is ever developed, as the inventor says it shortly will be, to sufficient perfection to enable it to take down speeches which may be written off verbatim, it is difficult to imagine the importance of the discovery, whether it be in respect to the unimpeachable accuracy of the process; the entire absence of trouble and expense in reporting any articulate sounds; or the great saving of the time and the exhausting labors of our parliamentary reporters.

PLAY UPON WORDS.—The latest and best play upon words, which amuses those who will be amused, and are to be amused with a trifle, is,—

— Pir —
— un —
— vent —
— vient —
— venir —
— d'un —

Un soupir vient souvent d'un souvenir.

LIBERTY—A TYRANT'S NOTION OF IT.—In Miss Strickland's "Bachelor Kings of England," the following anecdote is told of William Rufus: "Finding him deaf to all entreaties and remonstrances, his bishops and clergy at last presented a petition, beseeching him to allow them to compose a prayer to be used in all the churches of England, 'That it might please Almighty God to move his majesty's heart to choose a primate.' 'You may pray as you please,' replied Rufus, bluntly, 'but I shall do as I please.'"

PROLONGING THE BEAUTY OF CUT FLOWERS.—A recent author, E. A. Maling, states, that for keeping flowers in water, finely powdered charcoal, in which the stalks can be stuck at the bottom of the vase, preserves them surprisingly, and renders the water free from any obnoxious qualities. When cut flowers have faded, either by being worn a whole evening in one's dress, or as a bouquet, by cutting half an inch from the end of the stem in the morning, and putting the freshly trimmed end instantly into quite boiling water, the petals may be seen to become smooth and to resume their beauty, often in a few minutes. Colored flowers, carnations, azaleas, roses, and geraniums, may be treated in this way. White flowers turn yellow. The thickest textured flowers amend the most, although azaleas revive wonderfully. The writer has seen flowers that have lain the whole night on a table, after having been worn for hours, which at breakfast next morning were perfectly renovated by means of a cupful of hot water.

From The Saturday Review.

THE SAGUENAY AND THE MONTMORENCI.*

In a recent article on the St. Lawrence, we stated that we might take an early opportunity of noticing some of the more remarkable tributaries of that huge watercourse. It is true that their fine scenery has, as the author of *The Bothie of Toper-na-Fuosich* would lament, "got at last into guide-books." They have handled it, indeed, with all that coarse daubing which usually marks those feeble productions. That of Disturnell (its author, we have understood, as well as publisher), the title of which appears below, is, we believe, on the whole, the best thing in that shape for the Canadian tourist to have in his pocket. But it needs at least a thorough recasting. Of those subsidiaries of the St. Lawrence which appear in the little map of salmon-rivers given in Stanford's *Canadian Settler's Guide*, the Saguenay and the Montmorenci fill the largest space in what may be termed the literature of the travelling world. M. Kohl, however, in the entertaining work on Canada which we have already noticed, merely alludes in passing to the Saguenay, and seems to have only visited the *embouchure* of the Montmorenci. So we venture to think that even stay-at-home readers—to say nothing of those who may be contemplating a transatlantic tour—will welcome a brief sketch of these streams from the pen of one who has recently visited them, and whose personal inspection was supplemented by a perusal of the admiralty charts in the library of the Canadian Legislature.

The Saguenay, which joins the St. Lawrence about one hundred and thirty miles below Quebec, and more than twice that distance (two hundred and eighty) above Anticosti, is considered, analogously to the commencement of that river at the lower end of Lake Ontario, to begin its course as the outlet of Lake St. John. This lake, about one hundred and twenty miles from the mouth of the Saguenay, is a body of water no less than forty miles in diameter. It is fed by numerous streams, more than one of which must be twice the length of that river which forms their common outlet, and alone bears the name of Saguenay. We may assign, then, to this tributary system a length of not less than four hundred miles. From Lake St. John the river flows in a south-easterly direction, the St. Lawrence, from Kingston downwards, taking a north-easterly. As that lake is about one hundred and twenty miles north-west of Quebec, an imaginary line between these two points (say the proposed railroad) forms, in conjunction with the two rivers, an equilateral triangle.

The Saguenay is navigable as far as some rapids about seventy-five miles up, but at low water large vessels are stopped by a bar about sixty miles up. The width of the river below this bar is from two-thirds of a mile to two miles. Its depth is its most remarkable feature. According to Admiral Bayfield's accurate survey, it, as a general rule, slopes down from one hundred fathoms at its margin to one hundred and forty-five in its centre; while a recess thirty-four miles up it, called Eternité Cove, is proved to have the depth of a mile and a quarter, and one a little lower down, called St. Jean's Bay, that of a mile and a half. "If the bed of the St. Lawrence were laid dry," says the admiral, in the little book that accompanies his charts, "there would still be a depth of more than one hundred fathoms in the Saguenay." The heights through which it rolls are of syenitic granite and gneiss. They are uniformly precipitous, sometimes perpendicular, and seem to have been cleft open for it by some terrible convulsion of nature. A Greek would probably have accounted for the chasm by attributing to the river-god a power not inferior to that of the "earth-shaking" lord of the sea. The river is visibly affected by the tide full seventy-five miles from its mouth. Its color is a rich transparent mummy-brown. For this two causes suggest themselves—the bogs from which the river descends, and the pitch-pines on its margin. The latter is the cause assigned by Professor Agassiz for the color we observed in the Kahministikwoya, and which is found in the other tributaries of Lake Superior. In the case of the Saguenay, it is much deepened by the depth of water, and the shade of its lofty walls of rock. The Saguenay is a grand living likeness of that gloomy *inamabilis*

* *The Lakes and the River St. Lawrence.* With Maps and Embellishments. New York: Disturnell. 1857.

stream which contributes so much to the awfulness of the 6th *Æneid*.

We viewed this unrivalled scenery on the 19th of August. Our excursion steamer had left Quebec at 8 A.M. on the 18th, and, after touching at Rivière Ouelle, on the right bank, and Murray Bay on the left, reached Rivière du Loup on the right about 8 P.M. A thunder-storm had then just spent its strength, after lighting up the river, or rather gulf, most brilliantly with forked and sheeted lightning. We left Rivière du Loup at 3 P.M. on the 19th. At 6 A.M. we had passed Tadousac, a little village and Hudson's Bay Company's post at the mouth of the Saguenay, and on its left shore. It is said to have been one of the earliest French settlements, and its little church claims the honor of being the oldest in the New World. The heights on both sides of the river were of soilless rock scantily clothed with trees and lichen. The trees seemed to be birches and pines. Not far from the entrance of the river the captain pointed out white and pale-blue porpoises very near us, rolling over on the surface. The morning was very cold, as well it might be in a deep, dark gorge so far north for American latitudes. At breakfast-time we passed St. Louis Island, a huge rock shaped like a lion couchant. Just lower down, on the left bank, is a lovely amphitheatre of greenwood, where a tributary called the Ste. Marguerite joins the Saguenay, like a gentle, richly jewelled bride wedded to such a chief as Byron's *Corsair*. The walls that shut us out from the world became more and more lofty and precipitous, till they reached their climax in a majestic steep, clad in primeval forest, and a perpendicular bluff far barer and sterner. The former is, from its grandeur, termed Pointe d'Eternité, the latter Cap Trinité, either from a tripleness that has been discerned in its top, or from the desire of finding a name as sublime and awful as the former. Between them opens a most charming recess, named after the former headland, and, as we had occasion to mention just now, a mile and a quarter in depth. It lay embosomed in a ring of verdurous steeps, with those gigantic warders at its entrance. The scene could scarce be better described than by a transcript of a part of Virgil's sketch of the Libyan cove gained by his shipwrecked Trojans:—

"Hinc atque hinc vastæ rupes, geminique minantur
In cælum scopuli, quorum sub vertice latè
Æquora tuta silent: tum sylvis scena coruscis
Desuper, horrentique atrum nemus imminet umbrâ."

Down Pointe d'Eternité coursed a sweet little cascade, shaped like a V sideways (>). It ever and anon gleamed, like a silver cord, through the emerald drapery of that prince of river-steeps, which rises fifteen hundred feet above "the Stygian pool." A little further up the river, on the other side, and facing the west, was a remarkably brilliant cascade that we observed in our return. It was Shelley's *Arethusa* to the life. Many a longitudinal furrow in the rock was also often traceable where the verdure was richer and thicker, where birch and fir nestled lovingly, and where, doubtless, many a stream "leapt down" behind the veil of foliage. Up Cap Trinité, a gloomy bluff of syenitic granite, wound a zigzag procession of white birch-skeletons, like the ghosts of an old Roman triumph. On the same side of the river, further up, the cliff rises from the water as smooth as if the river-god had here exhibited on a godlike scale the power known, doubtless, through a dim tradition, to Attus Navius. There now opened on us a lake, some six or seven miles in diameter, on the right bank of the river. It is sometimes called La Grande Baie, sometimes Ha! Ha! Baie. The latter was, it is said, the name given it by its discoverers, in memory of the expression of joy that rose to their lips at the sight of nature no longer in the stern and gloomy aspect which she had been maintaining hitherto. As you reach it, the walls of the Saguenay are somewhat lower, and you see a blue chain of mountains in the far East. At the entrance of the bay you pass by bold bluffs; but at the other end the hills slope down, though half precipitously, with some little herbage. There are here two small settlements, termed St. Alexis and St. Alphonse, each possessing its wooden cottages and its simple church of the same material. We anchored off St. Alphonse in ten fathoms of water, and landed some horses and cows for the settlers, as well as a *calèche* and a hay-cart.

As we went up the river, we had an April-like sky, the very best possible for the scenery of the Saguenay. The light had gleamed fitfully on waving greenwood and still-rock

—now in its bare ruddiness, now browned yellowed, or whitened by lichen. As we went down, a rainbow, in parting, had a charming effect on the landscape. St. Jean's Bay has been already mentioned as a mile and a half deep. Its shores were fringed with ledges of light velvet-like green. Behind was the darker green of the live trees and the purple of the dead. Beyond, towered lofty heights of an indigo hue. A mist rested on a gray range in the distance. The gleam of the vanishing rainbow, like a little pillar of fire, glided over the heights, lighting them up with a brilliant purple dye. Before us rose the isle of St. Louis. Between it and our steamer glided a white-sailed bark, calling up the image of the fair sight the poet denied himself:—

> "The swan on still St. Mary's lake
> Floats double, swan and shadow."

As we gained on her, she shone in the calm expanse like a butterfly with head downwards. When we neared the mouth, the porpoises again frolicked by us, and the range along the opposite shore of the St. Lawrence appeared, some thirty miles off, with unusual clearness. Shortly after 6 P.M. we were speeding across by two low islands and their lighthouses. We had spent twelve hours in the enjoyment of scenery unique in its combination of gloom and grandeur. "Dis vayry uglee place," was the comment made on it by a Franco-Canadian steward, while, in the chill, cloudy morning, we passed through the sepulchral gorge. Scenery of the cheery kind, however tame in the eye of the cultivated observer, is to Jean Baptiste more welcome than the *sombre*, the *triste*, and the *sauvage*. This was the taste found by Dr. Arnold in the Tyrolese peasant. It was, indeed, that which reigned in London and Paris, before the days of Byron and the Lake Poets.

In comparison with the Saguenay, the Montmorenci is a river of but short course and very small volume. It rises in the western outskirts of the mountainous tract which shoots up its peaks on the northern side of the St. Lawrence, and forms so imposing a feature in the scenery between the mouth of the Saguenay and that of the St. Charles. Some seven or eight miles below the latter point, it falls—literally falls—into the great trunk-artery of North America. This charming fall is a perpendicular cascade of two hundred and forty feet. Its great beauty is the gossamer-like delicacy of its snow-white sheet, in contrast with the black rock. The stream above—of no greater width than sixty feet at its last leap—comes rushing through huge boulders, a mass of seething, inky water. A plain zigzag staircase and platform of deal, though disgustingly out of keeping with the scene, give such a near view of the fall as one could not otherwise get. It should also be seen from below; and we would, for this purpose—to say nothing of the river-views so obtained—advise a boating-trip from Quebec. In winter, an ice-cone, one hundred feet in height, is formed beneath, and down it is carried on the Canadian amusement called "tobogganing." The Montmorenci River should be traced up some two or three miles at least. Here is a highly picturesque scene, which has somehow got the childish and most inadequate name of the "Natural Steps." There is a rude view of it in *Harper's Magazine* for an early month in 1859. As was remarked last September, by the Correspondent of *The Times*, it is less known and visited than it deserves. This may be owing to the lack of a road to it. From the fall we found our way to it across the fields, having on our left a beautiful view of Quebec, on our right the woods that mantled the steep margin of the stream. Through them we descended to its brink by a very faint path. The scene—one spot especially—reminded us of the Wharf and its famous Strid. The stream, however, was one of a much greater volume, and suffered no stone to impede and anger its current. Its right bank, on which we stood, came sloping down, clad in primeval forest. As it approached the gorge, it shelved down in terraces of gray rock, gemmed here and there with the bluebell or a water-flower. Tiny rivulets trickled murmuringly over them. On the other side rose a perpendicular wall of rough gray cliff, crowned with greenwood. Pent up in the narrow gorge, which it seemed to cleave for itself out of the very ribs of mother earth, came a torrent rushing with a rapidity we never saw equalled. It boiled grandly, and the rich sepia of its deep murky water—not unlike, though darker than, the color of the Devonshire Lyns—contrasted well with the gray rock and white foam. There was a

succession of cataracts—one a particularly fine one, where the flood swept down with a thundering volume. We went up a little way, springing from terrace to terrace. The scenery was unchanged as far as we could well see, and melted into all embowering forest in the distance, with a background of mountains. We doubted not that a scramble further up would well repay the trouble; but the sun was declining, and we had before us the walk back to our *calèche*, and then a drive of eight miles to Quebec. So we resigned ourselves rather sulkily to the jolt back across the pleasant but monotonous meadows of the St. Charles. However, as we jogged on we were somewhat consoled by the fine views we had, embracing, as they did, the heights already mentioned, the valley, and the two rivers; while the tin-roofed town before us, the Nestor of New World towns, glittered in the golden sunset with a brilliance which seemed that of some erection of Oriental genii—nay, called up to our memory Martin's City of the Blest.

A Note on Sudden Deaths.—The sudden death of Lord Campbell, which shocked the nation, and brought grief to a wide circle, suggests a piece of counsel, on which it may be profitable to lay some stress. The fatal incident which closed the career of this noble lawyer, like those in the cases of the late Duke of Bedford and the Duke of Wellington, indicates the advisability of never permitting any aged or enfeebled person to sleep in a room alone, or without immediate and constant personal attendance. It is in the act of rising from bed, or suddenly assuming the erect position, or perhaps during some slight bodily exertion, that the unexpected moment of faintness or of collapse, of seizure or of sudden physical distress, occurs. The dead body is found stretched upon the floor, sometimes hours after life has been extinct. A guess is made as to what may have happened, and how long life has fled. The relatives are commonly comforted by the assurance that this is the inevitable stroke. But to keener and more judicial minds the question will arise whether this is absolutely true—whether immediate and instant help might not have been of some avail—whether the failing heart might not have been re-animated, the impetus or the vicious direction of the circulation modified, so as to give effectual relief to the overweighted brain, the limbs warmed, and perhaps the life lengthened. These speculations carried to the furthest point might be painful in individual cases, and in them not at all profitable. But the manner of death of many notable persons shows that the necessity for watchful and continuous attendance of the aged during the night season is too often ignored. This is commonly due to a false pride of strength, and wilful blindness to the sudden decrees of fate; but then it is the part of near relatives to overpower these feelings, and to set aside these scruples, in the presence of the lessons which experience has taught.—*Lancet.*

Night Telegraph Army Signals.—The old semaphore system of telegraphing, before electricity was pressed into service, is now being revived in America, Mr. Tuttle, of the Harvard Observatory, having recently invented a plan for communicating between lighthouses, forts, ships of war, etc., at night by means of signal-lights. A box containing a brilliant light is hoisted up on high. The front is an oblong aperture or apertures capable of being entirely cut off, or diminished to any length by levers. The signals consist of the same characters as those of the Morse telegraph, the different combinations of length with the number of times the light is cut off designating each letter of the alphabet; these are read by sight. The distance at which the light can be read depends upon the quality and size of the lens immediately behind the aperture. Lamps can be made at a very slight cost, which can be read ten miles with the naked eye, and by the aid of glasses twenty-five miles; or still more powerful lights could be used, which could be read twenty-five miles or more with the naked eye, and fifty or sixty with a telescope. Mr. Tuttle has experimented on this plan between the cupola of the State House and the top of Bunker Hill Monument, carrying on a spirited conversation without the slightest trouble; from ten to fifteen words per minute being transmitted with rough and imperfect machines.

The Employment of Camels in California.—Julius Bandman, who owns ten Bactrian camels, which Mr. Frisius imported from Siberia, is convinced, after months of experience and observation, that these camels are valuable for packing over mountains and plains. He trots them over the San Francisco sand hills daily, to eat thistles and exercise their muscles under bags of sand, each camel being able to carry easily six hundred and fifty pounds, and Fort Yuma officers say they can make thirty miles a day under one thousand pounds. The big humped brutes are models of temperance, rising at four o'clock, retiring at sunset, drinking water only, and that but once in ten days, when two buckets will suffice each animal. They are very healthy, ugly, and tractable; and the *Alta*, from which paper we condense these facts, intimates that packers ought to experiment with them in the Sierra Nevada.

From The Saturday Review.

DE QUINCEY ON STYLE. *

A SMALL volume has recently been published in which some of the minor miscellaneous writings of De Quincey have been put together. Among these is his Essay on Style, and those readers to whom this Essay is new will naturally turn with interest and curiosity to see what a writer who won so large a portion of his own reputation by his style has to say on the mechanism which he wielded so adroitly. The Essay goes to show that Englishmen do not pay enough attention to style, that a bad style is on the advance from the several influences to which we are exposed, and that there is such a thing as a model style towards which we can work. It is impossible to deny that there are many pleasing passages in the Essay, and many ingenious suggestions; but what chiefly strikes us in it is the oddity of a man who made style so great an object writing about style so very badly. The faults in mere style of this Essay are most glaring. De Quincey's style is generally admired, and it is useless to quarrel with a general verdict on a matter of taste; but even the warmest admirers of De Quincey must allow that he is one of the very hardest writers to remember that ever wrote. As we go on, sentence after sentence glides easily forwards, and we seem to be carried in some definite direction; but at the end of fifty pages no clear notions, no distinct, arguable propositions have been presented to us, or at best they have only been elicited with great effort from the mass of wandering thought and subtle elaborate language in which they are wrapped. Of all his works, this Essay on Style appears to us the worst written. It is impossible to follow the argument, or to say whether there is an argument or not. There are lengthy discussions of points that are seemingly irrelevant, and there also is a delusive organization of unconnected *excursuses* which is most puzzling and irritating. The merit of this Essay lies almost wholly in calling our attention in a pleasant way to some obvious facts, such as the fact that Frenchmen write short, clear sentences, while Germans write long, cumbrous sentences—or else, in clever suggestions of very minor and immaterial points, such as the suggestion that the schoolmen and the writers of Athens were influenced by a manner of living which was in many ways similar. But the merits of the Essay entirely fail to counterbalance its great defect—its total want of clearness and distinctness of thought. That De Quincey wrote an Essay on Style in a bad style, is in itself not very important; but the fact is important as bearing on the main problem, whether attention to style is necessary or even useful for the formation of a good style. The contrary hypothesis is, that a good style depends on the goodness of the thought—on its being clear, adequate, full, and duly connected with other thoughts that lie beside it or cross into and interlace its structure. Something there is beyond this—there is a happiness of expression, a discovery of the words that fit the thought, and, in a measure, are the thought. It is not improbable, and we venture to think it is highly probable—that no analysis can lay down rules by which this happiness can be attained. We do not find any thing in this Essay to lead us to believe that style can with advantage be expressly cultivated and consciously constructed.

The faults of a particular essay may be accidental, and it cannot settle the question as to the value of the study of style to find that De Quincey has laid himself open to severe criticism in this treatise. But it so happens that one or two of the faults which beforehand we should imagine would most naturally accompany a pride in the arts of diction are strikingly illustrated in this Essay. The most important of these faults is an indifference to truth—not the low indifference which tolerates falsehood or misstatement, but that carelessness which, so long as a train of thought pleases by its ingenuity, is content to overlook its irrelevancy. In discussing, for example, the conditions under which the masterpieces of Greek style were produced, De Quincey, as we have already said, observes that the great Greek authors are in some respects situated as the scholastic writers of the middle ages were. Both sets of writers had ample leisure; both had a paucity of books, and yet not an utter absence of them; both were fond of what may be termed subjective studies; and both wrote under the influence of a great enthusiasm—the Greeks under that of citizenship,

* *De Quincey on Self-Education, Style, Rhetoric, and Political Economy.* London: James Hogg and Son. 1861.

the schoolmen under that of Western Christianity. There is much that is worth thinking over in this comparison; but in the Essay we find that, in the first place, the whole disquisition is connected with the main subject of the treatise by a thread that it is almost hopeless to try to discover; and secondly, that in order that the comparison may seem to come to something, its author boldly lays down that the result was the same in both cases, or nearly so, and that the schoolmen, like the Greeks, wrote an admirable style. It is true, he adds, that the good qualities of their style are also found in the language of algebra; but then, so far as it goes, the language of algebra is a very good style. This is trifling with the reader, although the trifling is hid under a flux of words. The style of the schoolmen may be good in the sense that the style of algebra is good, but it is not good in the sense that the style of Sophocles is good; and if not, the real question which the comparison suggests is, whence does this diversity arise? It is difficult to suppose that this question would have been shirked by a writer of De Quincey's ability if he had not been satisfied with what he trusted were the triumphs of his writings. And the same sort of indifference to truth also appears in the delight with which he dresses up a thought which cannot be called untrue, but is poor and unmeaning. He begins, for example, a long passage in the middle of his description of Greek literature, by asking his readers if they know what dumb-bells are. He does this in a pleasant gossiping way, and we do not much care to ask what this has to do with the topic in hand. But at last the connection is forced on our attention, and we find that the use of the description of these dumb-bells is to say that Isocrates, who had a singularly long life, and came in the interval that separated the contemporaries of Pericles from the contemporaries of Alexander, may be compared to the long bar of a dumb-bell that connects the two weighty ends. That is all. It is a comparison that in itself is not at all instructive or apt. It is a poor thought to say that Isocrates is like the bar of a dumb-bell, but it is an odd thought; and a poor odd thought is the sort of raw material that a master of style likes to deal with.

Many opinions on the style of other writers are offered in this Essay, and it is not an unfair criterion of the worth of this formal treatment of style to inquire what are the critical results at which its author arrives. We are equally surprised at his likes and at his dislikes. He informs us that the best specimens of modern English are to be found in the letters of old maids. These are the models at which writers ought to aim. The letters of married women, of young ladies, and of men of all ages, are failures, but the letters of old maids are perfection. Obviously, De Quincey had just read the letters of some old maid before he wrote this opinion, and generalized a whole class of letter-writing from one instance. Nor do we think the general proposition at all true, that the style of women is best, not in their books, but in their letters. This De Quincey lays down as if it were a self-evident truth. With his habitual indifference to accuracy, he omits to inquire or to reflect how far this is true, if it is true. That women who write a pretentious style in their books are sometimes more simple in their private letter-writing is highly probable. Few people could pretend to a wide experience on the subject, but most people would expect to find that this was the case. That is about all that is true in De Quincey's proposition. That women who can write books write them in a worse style than that in which women who can write letters write their letters, is contradicted by abundant evidence. The style of Miss Austen's *Persuasion*, and the style of *Silas Marner*, is as good as could be wished. It may not be the style of the letters of old maids, but it is a style that answers every purpose of a novelist. Miss Martineau also writes a capital style—clear, neat, and unformal; but we do not see why it should be supposed that her letters would be in a different style or a better one.

With equal rashness of assertion De Quincey condemns Plato's style. He states that "the expletives of Plato are as gross, and must have been to the Athenian as unintelligible, as those of a Westmoreland peasant;" and he is indignant at the "morbid energy of oaths" scattered over the face of every prose composition both of Plato and of all writers of Greek dialogues. That the style of Plato is a bad or a good style is impossible to prove; but the general judgment of thousands of readers has pronounced it graceful,

apt, and copious in the highest degree. It is of no use entering into a controversy on such a point; but it is well worth remarking that De Quincey's depreciation of Plato is intimately connected with his hypothesis that there is a model style. He says that dialogues are an absurd way of writing—that the dummies who converse with the chief speaker are simply nuisances and excrescences—and that the conversational style which the dialogue enforces is the worst that can be used in a philosophical treatise, because it interrupts thought and reduces reflection and discussion to the consideration of a succession of isolated topics. Whether this is true or not, it must be acknowledged that dialogues have almost invariably failed. Readers do not like them. Cicero, who took more pains with his style than any other ancient prose writer, tried to write in dialogues, and failed. But Plato is held to have succeeded. Most readers find that the form of dialogue is a help to them in reading Plato, that the introductions are graceful and natural, and not mere outside ornaments, and that the conversational style does not stop consecutive thought. The obvious conclusion is, that style depends on the writer. Plato's dialogues are good—the dialogues of other persons are not good. That is to say, a vehicle of expressing thought which may suit one exceptional writer will not suit the bulk of writers. No rules of style could teach a writer of dialogues to write dialogues like Plato. What these rules apparently can do is to enable a critic to lay down that, on general principles, good dialogues must be considered bad.

De Quincey's main object in composing his Essay was to attack what he calls newspaper English. By this he means the use of grand, vague, inaccurate phrases to denote simple things. He tells us that he went to look for lodgings in a suburb of London, and that the woman who let them was, in his grand phraseology, "not merely a low-bred person, but morally vulgar, by the evidence of her own complex precautions against fraud, reasonable enough in so dangerous a capital, but not calling for the very ostentatious display of them which she obtruded upon us." This woman had several newspapers lying about, and she used, in talking, the following words,—category, predicament, individuality, diplomatically, and anteriorly. She is also stated to have assured De Quincey that she "would spontaneously adapt the several modes of domestication to the reciprocal interests." If she really said this, it only shows that she was too absurd to be fairly taken as a specimen of a class. It is, however, quite true that uneducated persons are very fond of using grand words and swelling phrases. As newapapers are often written by uneducated persons, they, too, exhibit this tendency, and their readers may gather or increase the taste by reading them. But these words are sometimes used rightly, and the style is sometimes clear and good in newspapers; and then the newspaper, like a well-written book, affects the taste of the uneducated reader only by supplying them with a treasury of fine words. If a pretentious, ignorant person read nothing but the Bible and Shakspeare—both unimpeachable models of style—he would collect together plenty of seven-leagued words and imposing expressions to gratify his coarse taste, and enable him to produce the effect in writing which delights him. It is useless to try to regulate style, as it is absurd to judge of it, by thinking what might be its possible effect on ignorant readers. The majority of educated Englishmen who have any thing to say, write, each after their fashion, a good style, and, in nine cases out of ten, their faults of style are really faults of thought. We do not see any great reason to believe either that there is such a thing as a model style, or that style becomes good by paying attention to it. There are a few mechanical rules, such as the utility of short compact sentences, the avoidance of parentheses, and so on, which can easily be taught and learnt. But all else in style that is good comes from clearness of thought, from education of taste, from an undefinable power of linking together the words and the thought. The perusal of great authors helps us to attain to excellence of style by suggesting to us stores of thought and a good vocabulary; but the analysis of style is almost sure to spoil our own method of composition, and to tempt us to imitate De Quincey in caring so much more for the expression than the accuracy of thought.

From The Independent, 6 Nov.

DE PROFUNDIS.

BY ELIZABETH BARRETT BROWNING.

THE face which, duly as the sun,
Rose up for me with life begun,
To mark all bright hours of the day
With daily love, is dimmed away,—
And yet my days go on, go on.

The tongue which, like a stream, could run
Smooth music to the roughest stone,
And every morning with "Good-day"
Made each day good, is hushed away,—
And yet my days go on, go on.

The heart which, like a staff, was one
For mine to lean and rest upon;
The strongest on the longest day
With steadfast love is caught away,—
And yet my days go on, go on.

And cold before my Summer's done,
And deaf in Nature's general tune,
And fallen too low for special fear,
And here, with hope no longer here,
While the tears drop, my days go on.

The world goes whispering to its own,
"'Tis anguish pierces to the bone."
And tender friends go sighing round,
"What love can ever cure this wound?"
My days go on, my days go on.

The past rolls forward on the sun
And makes all night. O dreams begun,
Not to be ended! Ended bliss!
And life that will not end in this!
My days go on, my days go on.

Breath freezes on my lips to moan:
As one alone, once not alone,
I sit and knock at Nature's door,
Heart-bare, heart-hungry, very poor,
Whose desolated days go on.

I knock and cry, . . . Undone, undone!
Is there no help, no comfort? None?
No gleaning in the wide wheat-plains
Where others drive their loaded wains?
My vacant days go on, go on.

This nature, though the snows be down,
Thinks kindly of the bird of June,
This little red hip on the tree
Is ripe for such. What is for me,
Whose days so winterly go on.

No bird am I to sing in June,
And dare not ask an equal boon,
Good nests and berries red are natures,—
To give away to better creatures,—
And yet my days go on, go on.

I ask less kindness to be done,
Only to loose these pilgrim-shoon
(Too early worn and grimed) with sweet
Cool deathly touch to these tired feet,
Till days go out which now go on.

Only to lift the turf unknown
From off the earth where it has grown,
Some cubit-space, and say, "Behold,
Creep in, poor heart, beneath that fold,
Forgetting how the days go on."

What harm would that do? Green anon
The sward would quicken, overshone
By skies as blue; and crickets might
Have leave to chirp there day and night
While my new rest went on, went on.

From gracious nature have I won
Such liberal bounty? May I run
So, lizard-like, within her side,
And there be safe, who now am tried
By days that painfully go on.

A voice reproves me thereupon,
More sweet than nature's when the drone
Of bees is sweetest, and more deep
Than when the rivers overleap
The shuddering pines, and thunder on.

God's voice, not nature's—night and noon
He sits upon the great white throne,
And listens for the creatures' praise.
What babble we of days and days?
The Day-spring He, whose days go on.

He reigns above, he reigns alone;
Systems burn out and leave His throne:
Fair mists of seraphs melt and fall
Around him, changeless amid all!—
Ancient of days, whose days go on!

He reigns below, he reigns alone,
And having life in love foregone,
Beneath the crown of sov'reign thorns,
He reigns the jealous God. Who mourns
Or rules with Him, while days go on.

By anguish which made pale the sun,
I hear him charge his saints that none
Among the creatures anywhere,
Blaspheme against him with despair,
However darkly days go on.

—Take from my head the thorn-wreath brown!
No mortal grief deserves that crown.
O supreme Love, chief misery,
The sharp regalia are for Thee
Whose days eternally go on.

For us, . . . whatever's undergone,
Thou knowest, willest what is done:
Grief may be joy misunderstood:
Only the good discern the good,
I trust Thee while my days go on.

Whatever's lost it first was won;
We will not struggle nor impugn.
Perhaps the cup was broken here
That Heaven's new wine might show more clear,
I praise Thee while my days go on.

I praise Thee while my days go on;
I love Thee while my days go on!

Through dark and dearth, through fire and frost,
With emptied arms and treasure lost
I thank Thee while my days go on!

And, having in thy life-depth thrown
Being and suffering (which are one),
As a child drops some pebble small
Down some deep well and hears it fall
Smiling . . . so I! THY DAYS GO ON!

OTHER WORLDS.

OTHER worlds. Those planets evermore
On their golden orbits swiftly glide on —
From quick Hermes by the solar shore
To remote Poseidon.

Are they like this earth? The glory shed
From the ruddy dawn's unfading portals —
Does it fall on regions tenanted
By a race of mortals?

Are there merry maidens, wicked-eyed,
Peeping slyly through the cottage lattice?
Have they vintage-bearing countries wide?
Have they oyster-patties?

Have they silent, shady forest-realms,
Odorous violets that in grassy nooks hide,
Aged oaks and great ancestral elms,
Growing by the brookside?

Does a mighty ocean roar and break
On dark rocks and sandy shores fantastic?
Have they any Darwins there to make
Theories elastic?

Have they landscapes that would set a flat alight
With their beauty? Have they snow-necked clerici?
Poets who be-rhyme each whirling satellite?
Dr. Temple's heresy?

Does their weather change? November fog —
Weeping April — March with many a raw gust?
And do thunder and demented dog
Come to them in August?

Nineteenth-century science should unravel
All these queries, but has somehow missed 'em.
When will it be possible to travel
Through the Solar System?

—*Temple Bar.* MORTIMER COLLINS.

COMING HOME.

O BROTHERS and sisters growing old,
Do you all remember yet
That home, in the shade of the rustling trees,
Where once our household met?

Do you know how we used to come from school,
Through the summer's pleasant heat;
With the yellow fennel's golden dust
On our tired little feet?

And how sometimes in an idle mood
We loitered by the way;
And stopped in the woods to gather flowers,
And in the fields to play;

Till warned by the deep'ning shadow's fall,
That told of the coming night,
We climbed to the top of the last, long hill,
And saw our home in sight?

And, brothers and sisters, older now
Than she whose life is o'er,
Do you think of the mother's loving face,
That looked from the open door?

Alas, for the changing things of time;
That home in the dust is low;
And that loving smile was hid from us,
In the darkness, long ago!

And we have come to life's last hill,
From which our weary eyes
Can almost look on that home that shines
Eternal in the skies.

So, brothers and sisters, as we go,
Still let us move as one,
Always together keeping step,
Till the march of life is done:

For that mother, who waited for us here,
Wearing a smile so sweet,
Now waits on the hills of paradise
For her children's coming feet!

PHŒBE CARY.

—*Chambers's Journal.*

CROWN AND CROSS.

IT seemed a crown of cruel thorn,
It seemed a cross of bitter scorn,
I bent my suffering brow to wear,
I raised my feeble arms to bear.

I might have cast away the crown,
But hands I loved had crushed it down,
And pressed its stinging points of pain,
Through quivering nerve, and bursting vein.

I might have shunned the cross to bear,
But One—the Master—placed it there;
And, failing the appointed task,
No other service I might ask.

As on my weary way I passed,
Ready to faint and fall at last,
The burden under which I bent
Became the staff on which I leant;

And blossoms for the thorns had place,
Upon my head a crowning grace,
That brought me through the burning hours,
The cool and healing touch of flowers.

* * * * *

My crown was love, maintained through loss,
And truth upheld through scorn my cross.

ISA CRAIG.

—*Englishwoman's Journal.*